
**PHASE II/III
ENVIRONMENTAL SITE ASSESSMENT REPORT**

**Baldwin Hardware Manufacturing Corporation
841 East Wyomissing Boulevard
Reading, Pennsylvania**

December 2009

Prepared for

**BALDWIN HARDWARE CORPORATION
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LEA Comm. No. 07MD306.001

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ACRONYMS

AEL	Averill Environmental Laboratories, Inc.
AST	Aboveground Storage Tank
BGS	Below Ground Surface
DEP	Pennsylvania Department of Environmental Protection
EDR	Environmental Data Resources, Inc.
EPA	United States Environmental Protection Agency
ESA	Environmental Site Assessment
LEA	Loureiro Engineering Associates, Inc.
MCLs	Maximum Contaminant Levels
MSCs	Medium Specific Concentrations
NGVD	National Geodetic Vertical Datum
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethylene
PETG	Polyethylene Terephthalate Copolyester
PID	Photoionization Detector
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RECs	Recognized Environmental Concerns
RPD	Relative Percent Difference
SCS	Soil Conservation Service
SOPs	Standard Operating Procedures
SPLP	Synthetic Precipitation Leaching Procedure
SVOCs	Semi Volatile Organic Compounds
TCA	1,1,1-Trichloroethane
TCE	Trichloroethylene
TPH	Total Petroleum Hydrocarbons
USGS	United States Geological Survey
USDA	United States Department of Agriculture's
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds
WWF/MF	Warm Water Fishes/Migratory Fishes
WWTP	Wastewater Treatment Plant

UNITS

gpm	Gallons per Minute
µg/kg	Micrograms per kilogram
µg/l	Micrograms per liter
mg/kg	Milligrams per kilogram
mg/l	Milligrams per liter
mg/m ³	Milligrams per cubic meter
µg/ m ³	Micrograms per cubic meter



1. INTRODUCTION

1.1 Overview

Loureiro Engineering Associates, Inc. (LEA) was retained by The Black & Decker Corporation to conduct a subsurface investigation of the Baldwin Hardware Manufacturing Corporation facility located at 841 East Wyomissing Boulevard in Reading, Pennsylvania (hereinafter referred to as "the Site"). Eighteen Recognized Environmental Conditions (RECs) having the potential to impact soil and groundwater were previously identified by LEA during a Phase I Environmental Site Assessment (ESA). Findings from the Phase I ESA are documented in the *Report of Phase I Environmental Site Assessment, Baldwin Hardware Manufacturing Corporation* dated August 2003. The subsurface investigations described herein were conducted at the Site during January through September of 2004.

1.2 Purpose and Scope

The purpose of the Phase II/III Subsurface Investigation was to develop an understanding of the potential future costs for remedial actions at the Site. Since the Site is an active manufacturing facility, the investigations were limited to accessible portions of each REC. In summary, the investigation activities included the following scope of work:

- A Site-wide soil vapor survey and targeted soil vapor sampling and analysis;
- The advancement of soil borings and the collection of soil samples for screening and laboratory analysis;
- The advancement of soil borings for borehole geophysical logging and packer testing;
- The installation, development, and testing of groundwater monitoring wells; and
- Groundwater sampling and analysis.

1.3 Report Organization

The report documents the investigation activities completed for the site, provides an interpretation of the physical and analytical data collected, and presents the conclusions drawn from these data. The following is a general description of the contents of each section of the report.

- Section 2 provides a summary of relevant background information;

- Section 3 describes the environmental setting of the Site and surrounding area, including topography, surface water drainage characteristics, and site and regional geology and hydrogeology;
- Section 4 describes methods and procedures used in conducting the Phase II/III investigation activities;
- Section 5 describes the quality assurance/quality control (QA/QC) measures and the data management procedures for documenting, verifying, and presenting the data collected;
- Section 6 summarizes the results of field investigation, including a summary of the laboratory analytical data for field and quality assurance/quality control (QA/QC) samples;
- Section 7 presents an evaluation of the results obtained from the Phase II/III investigative activities;
- Section 8 presents a summary of the findings and the conclusions based on the findings of the Phase II/III investigation activities; and
- Section 9 presents a list of references used in the preparation of this report.



2. BACKGROUND SUMMARY

2.1 Site Location

The Site is situated on the outskirts of the City of Reading, Pennsylvania and within the County of Berks (Figure 1-1). The Site has a physical address of 841 East Wyomissing Boulevard, Reading, Pennsylvania 19603 and is located at the northeast intersection of East Wyomissing Boulevard, Hancock Boulevard, and Wyomissing Boulevard. Located approximately one-half mile west of the intersection of State Routes 222, 422, and 10, the Site is identified on the Property Map of Berks County, Pennsylvania as Parcel Identifier: 5306 10 45 3607.

2.2 Site Description

The area surrounding the Site may be characterized as a mixed residential, commercial, and industrial setting. The Site is bounded to the East by property owned by Conrail (Reading Company Belt Railroad tracks) across which lies a community park (Schlegel Park); to the northeast by the Schuylkill River beyond which lies the City of Reading; and to the southeast by Interstate Container Corporation. The center of the Site is located approximately 2,500 feet southwest of the Schuylkill River. The Site is bounded to the south by Wyomissing Boulevard and land owned by the Reading Body Works. The Site is bounded to the west by East Wyomissing Boulevard. A low-income residential community is located on the west side of East Wyomissing Boulevard. Holy Name High School is located adjacent to the northwest corner of the Site property. The Site property is bounded to the north by land occupied by a radio tower.

2.3 Site Use

Baldwin manufactures a complete line of premium, decorative custom brass builder's hardware, including Mortise locks, key-in-the-knob entry locks, lock trim, letter box plates, doorknobs, door knockers, door stops, door levers, switch plates, cabinet hardware, and push/kick plates. Baldwin also manufactures home décor items and giftware including lamps, candlestick holders, candlesticks, candelabras, trivets, and sconces. In addition, Baldwin manufactures a complete line of lighting and bathroom accessories. These products are primarily manufactured from solid forged, machined, or stamped brass. These brass parts are then polished and protectively coated, with or without a plated finish. The plated finishes include polished brass, antique brass, polished and dull chrome, antique and dull bronze, and black nickel antique finishes.

2.4 Site Characteristics

The Site encompasses 28.17 acres and is occupied by a manufacturing facility (Drawing 1-1). The facility is comprised of three units: (i) a main manufacturing unit referenced herein as the “Central Unit”; (ii) a “Lower Unit” that is used primarily for storage and shipping; and (iii) an “Administration Unit” that is used primarily for administrative offices, a show room, and a small cafeteria. The Central and Lower Units together occupy approximately 260,000 square feet (sq ft), and are connected by an enclosed ramp.

Most of the manufacturing operations are conducted within the Central Unit. This Unit includes the original Site structure built in the spring of 1956 when Baldwin opened the facility. The Central Unit has expanded over time and the various additions to the Unit are referred to as “Buildings”. The buildings within this unit are numbered 1 - 12 and are shown on Drawing 1-2.

The Lower Unit is comprised of Building 50, Building 51, and Building 51A, and is connected to the Central Unit via an enclosed tunnel/ramp. Building 50 is currently used to receive and store materials and supplies, as well as to stage product prior to shipping. Built by Baldwin around 1983, Building 51 houses a large barrier plating line and chemical storage area. Building 51A houses chemical stripping operations and chemical storage tanks.

The Administration Unit is comprised solely of Building 75. This two-story building houses the administration, sales, marketing, and engineering departments, and includes a show room and small cafeteria.

2.5 Regulatory Background

Baldwin entered into an Administrative Order on Consent (AOC) with the United States Environmental Protection Agency (USEPA) in 1987 to remediate chlorinated volatile organic compounds (VOCs) in groundwater at its Property located at 841 East Wyomissing Boulevard in Reading, Pennsylvania (the property) pursuant to RCRA § 3008(h). In accordance with the AOC, Masco designed and installed a groundwater remedy consisting of a groundwater pumping and treatment (“pump-and-treat”) system. The AOC also required the implementation of a groundwater monitoring system to verify the extent of groundwater contamination and the effectiveness of the remedial action program (USEPA, 1985). The groundwater pump-and-treat system has been operating at the Property since April 1988. As designed, the groundwater pump-and-treat system operates by extracting contaminated groundwater from production wells that are screened in competent bedrock underlying the Property.

2.6 Groundwater Remediation System and Monitoring Well Network

A remediation system that pumps and treats contaminated groundwater pursuant to the AOC. The system consists of the following elements: an air stripping tower; three pumping wells (PS-1, PW-4, and PW-5); two “back-up” pumping wells (PS-2 and PS-3); and four monitoring wells (OW-1, OW-2, OW-3S, OW-3D). In addition, 20 piezometers (P-4S, P-4I, P-4D, P-5S, P-5D, PZ-10I, PZ-10D, PZ-20S, PZ-20I, PZ-20D, PZ-30S, PZ-30I, PZ-30D, PZ-40S, PZ-50S, PZ-50I, PZ-50D, PZ-60I, PZ-60D, and PZ-70I) are located on the Site and are used as groundwater elevation data collection points. Additional piezometers, P-1, P-2, P-3S, P-3I, and P-3D, which are used as part of the monitoring well network are located off-site. A table presenting the construction details for the existing monitoring wells and piezometers at the Site is included as Table 2-1.



3. ENVIRONMENTAL SETTING

3.1 Physiographic Setting

The Site is located within the Great Valley Section of the Valley and Ridge Physiographic Province (Pennsylvania Department of Environmental Protection (PADEP) 1992). This section is characterized by very broad, moderately dissected valleys having a gently undulating surface. The Site lies approximately one mile to the north of the boundary between the Great Valley Section and the northern edge of the Triassic Lowland Section of the Piedmont Physiographic Province.

3.2 Topographic Setting

The center of the Site property has been mapped within the USGS Reading, Pennsylvania Quadrangle at approximately -75° 56' 30" west longitude and 40° 19' 21" north latitude (Figure 1-1) (USGS 1999). The area surrounding the Site is characterized as having low to moderate topographic relief. The property slopes from north to south over an elevation of approximately 80 feet. The northern property boundary exists at an elevation of approximately 300 feet above mean sea level, referenced to the National Geodetic Vertical Datum (NGVD) of 1929. The southern property boundary exists at an elevation of approximately 220 feet above mean sea level.

3.3 Surface Water Drainage

The Site and surrounding area exist within the Schuylkill River Drainage Basin. The Site is situated between Wyomissing Creek, located approximately 2,000 feet to the north, and Angelica Creek, which is located approximately 6,000 feet to the south. Each tributary flows to the northeast and discharges into the Schuylkill River. A topographic high separates the Site from Wyomissing Creek.

Surface water runoff is controlled by a number of stormwater catch basins and by two drainage swales (Drawing 1-1). The drainage swales are located along the northern and southern property boundaries. In general, surface water drainage at the Site is to the south to southeast. Surface water flowing to the south across the Site is diverted east upon entering the drainage swale along the south property boundary and discharges at the southeastern corner of the property. Surface water flowing to the southeast drains directly to the Schuylkill River. The discharged surface water is directed through a drainage pipe that terminates at the Schuylkill River. The Schuylkill River is located approximately 2,500 feet northeast of the Site. The Schuylkill River empties into the Delaware River near Philadelphia, Pennsylvania.

3.4 Surface Water and Groundwater Quality

The DEP has adopted water quality classifications for the groundwater and surface waters of the state to categorize the existing quality of the water, the potential uses of the water, allowable discharges to the water, and the long-term state goals for water quality restoration. Surface waters and groundwater are classified separately, and both classification schemes are based on the water quality standards as specified by the PADEP.

3.4.1 Surface Water Quality

The surface water classification of the Schuylkill River nearest the Site is “Warm Water Fishes/Migratory Fishes (WWF/MF)” (PADEP 2004). This fish aquatic life-use standard is the basis for all standards of surface water quality.

3.4.2 Groundwater Quality

Regional groundwater flow is from west to east across the Site with discharge to the Schuylkill River. Groundwater withdrawals at the Site, however, have resulted in local groundwater flow to the south-southeast. This local variation in flow from the regional flow conditions is most likely due to the fact that for the past 15 years, Baldwin has almost continuously extracted groundwater from the site at a rate of approximately 250-300 gallons per minute (gpm).

Groundwater exists at the Site within bedrock. However, as presented in this report groundwater exists within unconsolidated overburden in some areas of the Site, at least temporally. The Site bedrock has virtually no primary porosity. The bedrock appears to contain thin fractures through which small amounts of groundwater flow. The bedrock also contains voids or solution fractures ranging in thicknesses of up to ten feet that are capable of producing greater quantities of water. There appears to be a hydraulic connection of unknown magnitude between the thin fractures and the thick, solution fractures or voids. The fractured limestone aquifer behaves as a single hydraulic unit when considered on a macro scale.

A vertical component of groundwater flow exists within the bedrock aquifer at the Site. The deep portion of the aquifer has a net upward component of groundwater flow, while the shallow portion of the aquifer has a net downward component of groundwater flow. It is noted that the Site lies within a zone of recharge. However, this zone terminates within the intermediate portion of the aquifer.

Groundwater contamination exists on Site, reportedly as a result of the facility’s past usage of two unlined “drying beds”(surface impoundments) used for the storage of electroplating waste water treatment sludge.

3.5 Regional Geologic Setting

3.5.1 Regional Geologic Conditions

The regional geologic conditions of the Valley and Ridge Physiographic Province are characterized by highly folded and faulted sedimentary lithologic units that range in age from Lower Cambrian to Silurian (PADEP 1992). Following original deposition and lithification of the limestone, dolomite, sandstone, and shale units that comprise the general rock types for this region, a collision of continental plates resulted in the low-angle (thrust) faulting and tilting of stratigraphic beds. Locally, intrusive igneous rock bodies such as dikes and sills are present, having intruded the surrounding country rock.

3.5.2 Regional Bedrock Conditions

Due to the extensive folding and faulting of the sedimentary rock layers that dominate the region, bedrock conditions vary greatly. In many locations, thrust-faulting has resulted in the placement of older rock units on top of younger units. The presence of splinter faults, fractures, and joints is well-documented (PADEP 1992). Strike of beds is generally oriented in a northeast to southwest direction, with varying dips of approximately 15 to 90 degrees, and with overturned beds. Secondary bedrock features such as voids are also present in the limestone-rich beds that are prevalent, especially in the valleys of the region.

3.5.3 Regional Hydrogeologic Conditions

According to *Geology and Groundwater Resources of Northern Berks County, Pennsylvania* (1992), regional groundwater flow relative to the Site is from southwest to northeast, with discharge to the Schuylkill River. Regionally, the hydrogeologic conditions are influenced by significant numbers of fracture traces. These geologic features are usually comprised of faults, joints, or contacts between bedding planes.

3.6 Site-Specific Geology and Hydrogeology

The geology of the Site has been determined from multiple sources, including a Pennsylvania Department of Environmental Resources-published map entitled *Geology and Mineral Resources of the Reading and Birdsboro Quadrangles, Berks County, Pennsylvania* (1992), as well as from an inspection of geologic materials encountered during the advancement of soil borings at the Site.

3.6.1 Surficial Geology

The United States Department of Agriculture's (USDA's) Soil Conservation Service (SCS) has characterized the surface soils in the vicinity of the Site as well-drained silt loam soils (Hagerstown Silt Loam). These fine-grained silt and clay soils are characterized as having intermediate water holding capacity. These soils do not meet the requirements of a hydric soil.

Site subsurface soils consist predominantly of sandy silts and sandy clays weathered from the underlying carbonate bedrock. The unconsolidated soils at the Site vary in thickness from 20 to 100 feet below ground surface (bgs). The variation in the thickness of the unconsolidated subsurface soils has resulted from differential weathering of the underlying carbonate system.

3.6.2 Bedrock Geology

Carbonate rocks consisting primarily of limestone and dolomite underlie the Site and surrounding area. In the area of the Site, the carbonate rocks are inter-bedded with shale sequences. The bedrock formation beneath the Site has been mapped by the USGS and the PADEP as the Buffalo Springs Formation, a light gray to pinkish gray finely to coarsely crystalline limestone and inter-bedded dolomite of middle Cambrian age (PADEP 1992). Bedrock outcrops at the Site. Bedrock strike between N50-60°E with a gentle dip to the North (14-20°) was measured by the PADEP at an outcrop adjacent to the Central Unit and monitoring well OW-2. Differential weathering of the underlying carbonate system is evidenced by sinkholes observed at the Site at the ground surface.

3.6.3 Hydrogeology

Primary porosity and permeability of the limestone and shale bedrock typical for the Site is generally low. However, significant secondary permeability has developed in the bedrock of the Site through fractures and joints associated with the thrust-faulting of the region. Dissolution of the limestone has created voids through which groundwater can migrate. A significant void has been identified and is intersected by production well PW-5.

Groundwater contour maps for the principal water bearing zones were generated from groundwater elevation data collected on September 7, 2004 and are presented as Drawings 3-1 through 3-4. The groundwater contour maps indicate that the direction of groundwater flow beneath the Site is generally to the southeast.

4. METHODOLOGIES

4.1 Overview

This section describes methods and procedures used in conducting the Phase II/III investigation activities. The field investigation activities described in this section were designed to provide an initial level of characterization of the presence or absence of gross soil contamination at each of the RECs identified during Phase I ESA. The field investigation activities were also designed to assess the potential for off-site contaminant migration.

4.2 Soil Vapor Sampling and Analysis

4.2.1 Overview

A soil vapor survey was performed at the Site to locate volatile organic compounds (VOCs), particularly halogenated VOCs, present within the subsurface soils above the saturated zone. The survey involved analyzing soil vapor samples obtained from locations across the Site. The results of the survey were used to identify soil boring and soil sampling locations for subsequent source area investigation activities conducted at the Site.

The results of the survey were also used to identify areas at the Site that present the greatest potential for soil vapor intrusion into the overlying buildings. Additional soil vapor samples were obtained from these areas for laboratory analysis. A description of the Site-wide soil vapor survey and subsequent soil vapor sampling and analysis is presented below.

4.2.2 Site-Wide Soil Vapor Survey

The soil vapor survey was performed in accordance with LEA's *Standard Operating Procedure for Soil Vapor Surveying*. The soil vapor survey consisted of a Site-wide area survey. The areas encompassed by the survey included:

- The entire area occupied by the Central Unit;
- The area south of the eastern-most portion of the Central Unit;
- The area east of the Lower Unit; and
- Various areas identified during the Phase I ESA as areas possibly containing unspecified fill material, including the area east of the upper parking lot.

These areas include areas of the Site where manufacturing processes may have resulted in a release of VOCs to the subsurface. The soil vapor survey consisted of overlaying a 40 by 40-foot sampling grid onto these areas, collecting soil vapor samples from the subsurface, and analyzing the samples for VOCs. In general, the soil vapor samples were collected at the locations identified by the nodes of the grid. However, some soil vapor samples were collected at locations off of the grid because the node locations were inaccessible. A total of 312 soil vapor samples were obtained. The locations of the soil vapor survey samples are depicted on Drawing 4-1. The sample locations were properly abandoned by backfilling the holes with a bentonite slurry and by topping the slurry with hydraulic cement or asphalt patch, as appropriate.

The soil vapor samples were collected using a vapor probe system temporarily installed to a depth of approximately three feet below the ground surface. At some locations, however, the vapor probe system could not be advanced to this depth due to shallow bedrock conditions. At these locations the soil vapor samples were collected from a shallower depth.

Using a vacuum pump, soil vapor was extracted from the vapor probe system and was screened for the presence of VOCs using a handheld portable VOC analyzer equipped with a photoionization detector (PID). A discrete soil vapor sample from each location was then extracted and collected directly into a Tedlar[®] bag. Each Tedlar[®] bag vapor sample was then analyzed on-Site by LEA using a field portable gas chromatograph (GC). Each sample was analyzed for select VOCs consisting of benzene, toluene, 1,1,1-trichloroethane (TCA), tetrachloroethylene (PCE), and trichloroethylene (TCE), in general accordance with LEA's *Standard Operating Procedure for Modified EPA Method 3810 Static Headspace Analysis of Volatile Organic Compounds Using the Photovac[®] 10S50 Gas Chromatograph* (Appendix A).

4.2.3 Additional Soil Vapor Sampling and Analysis

Based on the results of the soil vapor survey, areas of the Site were identified that present the greatest potential for soil contamination. Additional soil vapor samples were obtained from these areas for more comprehensive laboratory analytical testing by Air Toxics Limited of Folsom, California (Air Toxics). These areas included:

- the area of the existing TCE vapor degreaser within Building 3 of the Central Unit;
- the area west of the existing TCE vapor degreaser within Building 12 of the Central Unit; and
- the area surrounding the photo vapor deposition (PVD) unit within Building 51 of the Lower Unit.

The additional soil vapor samples were identified as: SV-03-01 through SV-03-06 (Building 3); SV-12-01 through SV-12-06 (Building 12); and SV-51-01 through SV-12-05 (Building 51). In addition, QA/QC samples were obtained at the time of sampling. The QA/QC samples included a background soil vapor sample, identified as SV-BK-01, and an outdoor ambient air sample, identified as SV-AMB-01. Both QA/QC samples were obtained from an area outside of the northwest corner of Building 3. The locations of the additional soil vapor survey samples are presented on Drawing 4-1. The soil vapor samples were obtained in accordance with LEA's *Standard Operating Procedure for Soil Vapor Surveying*. The sample locations were properly abandoned by backfilling the holes with a bentonite slurry and by topping the slurry with hydraulic cement or asphalt patch, as appropriate.

The soil vapor samples were collected in one-liter (l) stainless steel Summa canisters. The canisters were shipped via overnight courier along with proper chain-of-custody documentation to Air Toxics. Air Toxics analyzed the samples for VOCs in accordance with United States Environmental Protection Agency (EPA) Method TO-15.

4.3 Soil Sampling

4.3.1 Overview

Soil sampling was conducted as part of the Phase II/III activities in assessing the potential sources of soil contamination for the RECs identified during the Phase I. Soil sampling included the collection of surface soil as well as subsurface soil samples. In general, the samples that were obtained were placed into the sample containers provided by the analyzing laboratory. Care was taken to completely fill each sample container intended for analysis. Large void spaces within each container were minimized by packing the container. The rim of each sample container was wiped with a clean paper towel to remove excess solids, thus ensuring a properly sealed container. The specific methods and procedures that were used to collect the soil samples during the Phase II/III investigation are described in this section. Descriptions of the specific sampling locations and sampling intervals are provided for each REC in Section 5.

Based on the potential contaminants of concern for a particular sampling location, the soil samples were submitted for one or more of the following constituents: VOCs by EPA Method 8260B, polychlorinated biphenyls (PCBs) by EPA Method 8082, semi-volatile organic compounds (SVOCs) by EPA Method 8270C, total petroleum hydrocarbons (TPH) by EPA Method 418.1, and select metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver and zinc) by 7000-series of EPA mass analytical methods. Additionally, select soil samples were analyzed for metals and/or SVOCs following the Synthetic Precipitation

Leaching Procedure (SPLP). Soil samples were selected for SPLP analysis based on their relative mass concentrations. Descriptions of the specific parameters for which the samples were analyzed are provided for each REC in Section 5.

4.3.2 Surface Soil Sampling

Surface soil samples were obtained from a depth of 0 to 1 foot below ground surface (bgs) using a decontaminated stainless steel sampling trowel or spatula. Each sample was transferred directly into appropriate containers provided by the analyzing laboratory. Each sample was placed and secured within a cooler along with appropriate chain-of-custody documentation, pending transportation to the analyzing laboratory.

4.3.3 Subsurface Soil Sampling

Subsurface soil samples from depths greater than one foot bgs were obtained from boreholes advanced using Geoprobe[®] Direct-Push techniques. Specifically, the soil borings were advanced with the LEA Geoprobe[®] 6610-DT equipment in accordance with LEA's *Standard Operating Procedure for Geoprobe[®] Probing and Sampling*. In accordance with this procedure, boreholes were advanced using a Geoprobe[®] Macro-Core[®] Liner system. This system consists of a 48-inch long by 2-inch outside diameter steel sampling tube outfitted with disposable 46-inch long by 1.75-inch diameter polyethylene terephthalate copolyester (PETC) liner and fitted piston tip. The entire unit was driven to the top of the sampling interval with the Geoprobe[®] rig. The purpose of the fitted piston tip was to seal the end of the sampling tube against the introduction of unconsolidated materials during advancement. The piston tip was released, the sampling system was driven to the final sampling depth by a combination of percussive hammering and direct pressure, and the sampling system was retrieved. The soil-filled liner was removed from the sampling system and was transferred to the supervising geologist for logging and sample collection. For areas of the Site that were not accessible by the LEA Geoprobe[®], soil borings were advanced manually in accordance with LEA's *Standard Operating Procedure for Hand Auger Borings*.

Soil borings were generally advanced to a depth below the zone of any identified contamination, or to the depth at which refusal occurred. At select locations, soil borings were advanced to a depth of four feet. Descriptions of the specific sampling locations and sampling intervals are provided for each REC in Section 5.

During the advancement of each soil boring, soil samples were collected continuously in accordance with LEA's *Standard Operating Procedure for Soil Sampling*. For each soil boring, soil samples were obtained in two-foot intervals from the ground surface to the final depth of the

soil boring. Soil samples were collected from the liners using pre-cleaned stainless-steel spatulas. All soil samples were examined by the supervising geologist for indications of contamination, such as visible staining. After collection, all soil samples were screened in the field for the presence of VOCs using a portable VOC analyzer equipped with a PID.

Once screened, each sample was collected directly into laboratory-supplied glass sample containers with Teflon[®]-lined lids. The samples were then submitted to the laboratory for analysis. The sample containers were placed and secured within a cooler along with appropriate chain-of-custody documentation, pending transportation to the analyzing laboratory.

All subsurface soil samples were screened at the LEA Analytical Laboratory for the presence of target VOCs consisting of benzene, toluene, TCA, PCE, and TCE. Screening was performed in general accordance with LEA's *Standard Operating Procedure for Modified EPA Method 3810 Static Headspace Analysis of Volatile Organic Compounds Using the Photovac[®] 10S50 Gas Chromatograph*. The results of the screening analysis were utilized by LEA on a real time basis to direct investigation activities and to select samples for fixed laboratory analytical confirmation. In general, up to two samples per soil boring were selected for fixed laboratory analysis at Averill Environmental Laboratory, Inc. (AEL).

4.3.4 Borehole Logging

The unconsolidated materials that were encountered during the advancement of the soil borings were examined by the supervising geologist. A description of the materials was logged using a modified Burmister Classification System. The geologic descriptions were recorded on standardized Geologic Boring Log forms in accordance with LEA's *Standard Operating Procedure for Geologic Logging of Unconsolidated Sedimentary Materials*.

The information recorded on each Geologic Boring Log included the percentage of the sample recovered relative to the length of the sampling interval, the estimated primary grain size ranges according to the Burmister Classification System, secondary grain size ranges, color, relative degree of water saturation, and visible sedimentary structures. In addition, the presence of extraneous materials and foreign objects was also recorded, as was the presence of staining. Copies of Geologic Boring Logs for the soil borings advanced at the Site are included in Appendix B.

4.3.5 Borehole Abandonment

Boreholes were abandoned by backfilling the open borehole with a 5.5% bentonite-cement grout or with bentonite chips. The bentonite-cement grout was pumped to the bottom of the borehole using a tremie pipe. The bentonite chips were poured slowly into the borehole to avoid bridging. The bentonite chips were then hydrated with potable water to induce swelling and to seal the borehole.

4.3.6 Test Pits

Test pits were excavated in four areas of the Site where, based on the findings of the Phase I ESA, fill may have historically been placed. These areas are shown on Drawing 4-1. The test pits were excavated using a Komatsu excavator. Subsurface soil samples obtained from the test pits were collected using a stainless steel trowel or spatula in accordance with LEA's *Standard Operating Procedure for Test Pit Sampling*. Each sample was transferred directly into appropriate containers provided by the analyzing laboratory. Each sample was placed and secured within a cooler along with appropriate chain-of-custody documentation. Upon the completion of sampling, each test pit was backfilled with the excavated materials.

4.4 Monitoring Well Installation

4.4.1 Overview

During the course of the Phase II/III investigation, a total of 14 monitoring wells were installed at the Site. The wells include those identified as monitoring wells MW-01, MW-02, MW-03, MW-04, MW-05D, MW-05S, MW-05I, MW-06, MW-07S, MW-07D, MW-08, MW-08D, MW-08S, and MW-09. The locations of these wells are illustrated on Drawing 1-2. All of the monitoring wells, with the exception of monitoring wells MW-06 and MW-08, were completed in bedrock. Monitoring wells MW-06 and MW-08 were completed within the unconsolidated sedimentary materials overlying the bedrock.

In general, the procedure for installing the monitoring wells at the Site involved the advancement of a borehole, flushing the borehole to remove drill cuttings, and conducting borehole geophysical logging and testing on the borehole. Based on the information obtained during this process, the monitoring wells were constructed. The methods and procedures used to install the monitoring wells are described in more detail below.

4.4.2 Borehole Advancement

With the exception of monitoring well MW-08, the boreholes for all of the monitoring wells were advanced using an Ingersoll-Rand T-4 Air Rotary Drill Rig. Using the air rotary drilling techniques, the borehole is typically advanced with a cutting head attached to hollow steel rods that are rotary driven by the drill rig. Compressed air enters the steel rods from the rig to cool the cutting head and force the drill cuttings out of the hole. During drilling, the supervising geologist logged the cuttings to describe the geologic materials encountered.

In advancing the boreholes from monitoring wells MW-07D and MW-08D, a fracture system that is hydraulically connected to production well PW-5 was encountered. An increase in the total suspended solids (TSS) pumped from production well PW-5 was observed during the borehole advancement process. To avoid jeopardizing the integrity of production well PW-5 and/or the groundwater pump set within this well, borehole advancement was terminated upon encountering the fracture system at each of the locations for monitoring wells MW-07D and MW-08D.

The borehole for monitoring well MW-08 was advanced using the LEA Geoprobe® 6610-DT direct-push equipment. The borehole advancement method used is similar to that described in Section 4.4.3 for subsurface soil sampling using Geoprobe® Direct-Push techniques. A borehole was also advanced using this method for an overburden well proposed for the location adjacent to monitoring wells MW-07S and MW-07D. A monitoring well was not installed at this location, however, because groundwater was not encountered within the shallow overburden at this location. In this area of the Site, bedrock was encountered at an approximate depth of 21 feet bgs. Upon completion, each borehole was developed to remove drill cuttings in preparation of borehole geophysical logging and packer testing.

4.4.3 Borehole Geophysical Logging and Packer Testing

LEA subcontracted Earth Data Northeast Inc. (Earth Data) to conduct borehole geophysical logging and packer testing on the boreholes for monitoring wells MW-01, MW-02, MW-03, MW-04, MW-05D, and MW-09. Borehole geophysical logging and packer testing were also performed on production well PS-3, an open-rock well. The purpose of the geophysical logging and packer testing was to identify the water bearing zones penetrated by the boreholes and to identify the yield and water quality of those zones. Specifically, the purpose of conducting this testing was to identify preferred pathways for contaminant migration. A description of each of these geophysical tests is provided below.

4.4.3.1 Borehole Geophysical Logging

Electric Log

The electric log is a multi-electrode tool that measures parameters relating to the flow of electrical currents within the borehole and surrounding material. The electric log can only be used below the groundwater surface. Parameters of the tool used are spontaneous potential, single point resistivity, and short and long normal resistivity.

The spontaneous potential (SP) log measures the electrical potential voltages, measured in millivolts that can develop at the contact of dissimilar geologic units. A common SP source in a borehole is electrochemical potential. This effect is generally a result of the migration of ions from a concentrated solution to a diffuse solution. The migration of ions decreases with the presence of shale or clay layers, resulting in an increase in the SP.

The single-point resistance (SPR) tool measures the apparent formation resistivity in ohms. Current flow is impacted predominantly by effective porosity and interstitial fluid salinity. Typically, a formation with a high sand content will have a high SPR, and a formation with a high clay or shale content will have a low SPR.

The normal-resistivity tool measures the electrical resistivity of the borehole and surrounding rock. The units measured are ohms-meters. Short normal-resistivity measures a 32-inch diameter area around the tool, and long normal-resistivity measures a 128-inch diameter area around the tool. Normal resistivity logs are commonly used to measure water quality and formation resistivity. Portions of the borehole that exhibit a lower resistivity are expected to be lower in shale or clay content.

Natural Gamma

The natural gamma logs measure, in counts per second, the amount of natural gamma radiation emanating from the stratigraphic units. Because shale and clay are relatively higher in natural gamma radiation than units with higher sand content, the gamma log is used to identify changes in lithology within the borehole. A description of each of these geophysical tests is provided below.

Caliper

The caliper tool is used to measure the diameter of the borehole. In an uncased borehole, the caliper tool can reveal the presence of fractures or voids in the sidewalls of the borehole.

Fluid Temperature

The fluid temperature log measures the temperature of the water in the borehole. Abrupt changes in fluid temperature can reveal where water of differing temperatures and/or quality are entering or exiting the borehole.

Fluid Conductivity

The fluid conductivity log provides electrolytic measurements of the formation water in microsiemens per centimeter. Water with a lower concentration of total dissolved solids (TDS) will yield a lower fluid conductivity and water with a higher concentration of TDS will yield a higher fluid conductivity. If enough information is known about contamination levels in a borehole, some conclusions may be drawn using the conductivity log. Fluid conductivity logs will indicate changes in the borehole fluid where water-producing fractures are transmitting water of contrasting composition into or out of the borehole.

Heat Pulse Flowmeter

The heat-pulse flow meter is a stationary tool that is placed at pre-determined locations within the borehole to measure the vertical flow, if any, at the given location. Points to measure vertical flow are selected based on the response of caliper, fluid temperature, and/or fluid conductivity logs. The heat-pulse flow meter is designed to measure relatively low flow rates, generally 0.33 to 9.84 feet per minute.

Borehole Video

The borehole video is comprised of a downhole camera connected to a video monitor. The camera is deployed into the borehole and observations are made at the video monitor at the ground surface. The video can reveal characteristics of the geologic formations in an uncased borehole, such as the degree of fractures or voids.

The results of the geophysical borehole logging are provided in Appendix C.

4.4.3.2 Packer Testing

Packer tests were conducted within the boreholes for monitoring wells MW-01, MW-02, MW-03, MW-04, MW-05D, and MW-09. Packer testing was also conducted within production well PS-3, an open rock well. The purpose of the testing was to identify the water-bearing zones within the boreholes and to collect water quality samples from these intervals.

The packer tests were performed in various interval depths within each well. Intervals selected within the borehole were isolated from the remaining open bedrock borehole by means of a straddle packer assembly. Durable, natural rubber-coated bladders were inflated with nitrogen in order to expand each packer's diameter to form a seal against the borehole wall. Within these isolated borehole segments, measurements of hydraulic gradient were recorded and discrete water quality samples were collected for laboratory analysis. The hydraulic gradient is used along with the pumping rate to determine the interval's specific capacity. The interval within each individual borehole with the highest specific capacity is the principal water-bearing interval. The results of the packer testing are provided in Appendix C. The main water-bearing intervals with their depths and elevations are presented in the table below.

Well	Primary Water-Bearing Interval	
	Depth (ft bgs)	Elevation (ft amsl)
MW-01	75.00-107.76	192.05-159.29
MW-02	31.91-69.00	240.33-203.24
MW-03	87.00-98.91	208.54-196.63
MW-04	72.00-99.86	194.14-166.28
MW-05D	148.00-202.15	107.32-53.17
MW-09	52.56-79.00	210.24-183.80
PS-3	360.00-559.00	-97.28- -296.28

Notes:

ft bgs - feet below ground surface

ft amsl - feet above mean sea level

4.4.4 Monitoring Well Construction

Based on the information obtained during the advancement of the boreholes, the borehole geophysical logging, and the packer testing, monitoring wells were constructed within the boreholes. Monitoring wells MW-01, MW-02, MW-03, MW-04, and MW-09 were constructed of four-inch diameter, Schedule 40 polyvinyl chloride (PVC) screen and casing. Monitoring wells MW-05S, MW-05I, MW-05D, MW-06, MW-07S, MW-08, and MW-08S were constructed of two-inch diameter, Schedule 40 polyvinyl chloride (PVC) screen and casing. A sand filter

pack was placed within annulus of the screened interval of each well to allow groundwater to enter the well. For each well, a bentonite seal was placed within the annulus above the sand filter pack. The remaining annulus of each well was grouted using a 5.5% bentonite-cement grout. The monitoring wells were completed within a water-tight manhole, set within a concrete collar that is flush with the ground surface for those wells located within a paved area (MW-01, MW-02, MW-03, MW-04, and MW-09). The monitoring wells were completed within a protective steel casing that sticks up above the ground surface for the wells located along the southern property boundary (MW-05S, MW-05I, MW-05D, MW-06, MW-07S, MW-08, and MW-08S). Once completed, each monitoring well was developed to ensure that the well is hydraulically connected to the surrounding aquifer.

Monitoring wells MW-07D and MW-08D were constructed as open bedrock wells to avoid jeopardizing the integrity of production well PW-5 and/or the groundwater pump set within this well, as discussed in Section 4.4.2. These monitoring wells were completed within a protective steel casing that sticks up above the ground surface. Construction details for the newly installed monitoring wells and the existing wells at the Site are provided in Table 2-1.

For the flush-mount wells, the top of the casing is fitted with an expandable locking cap and lock. For all wells that are set within a protective steel casing, the casing is fitted with a steel locking cap and lock. All monitoring wells were installed and developed in accordance with LEA's *Standard Operating Procedure for Installing & Developing Monitoring Wells and Piezometers*. Copies of the monitoring well construction logs are provided in Appendix D.

4.5 **Site Survey**

LEA subcontracted L. Robert Kimball & Associates, Inc. of Ebensburg, Pennsylvania to survey the Site features. The survey included aerial photography, the establishment of ground control, and digital mapping to provide data of the Site at a one inch to 100 foot (1" = 100') scale. This survey included topographic contours provided at two-foot intervals. The survey also included an A-2 boundary survey on the tract owned by Baldwin, limited: (i) to establish the property boundary between Baldwin and the Reading Body Works property to the south; and (ii) to establish the property boundary between Baldwin and the Norfolk-Southern property to the east. Once the monitoring wells were installed at the Site, L. Robert Kimball & Associates, Inc. also surveyed the locations and elevations of the monitoring wells relative to the existing Site datum. The survey included the recording of the ground surface, top of steel casing, and top of PVC casing elevations to an accuracy of ± 0.01 feet for the monitoring wells installed at the Site. The recorded elevations are provided for each well in Table 2-1.



4.6 Groundwater Sampling

4.6.1 Overview

Two rounds of groundwater sampling were conducted during the Phase II/III investigation. In March 2004, groundwater samples were obtained from the monitoring wells, piezometers, and production wells existing at the Site. These wells and piezometers include:

- Four onsite groundwater monitoring wells designated as OW-1, OW-2, OW-3S, OW-3D;
- 20 onsite piezometers designated as P-4S, P-4I, P-4D, P-5S, P-5D, PZ-10I, PZ-10D, PZ-20S, PZ-20I, PZ-20D, PZ-30S, PZ-30I, PZ-30D, PZ-40S, PZ-50S, PZ-50I, PZ-50D, PZ-60I, PZ-60D, and PZ-70I; and
- Five offsite piezometers designated as P-1, P-2, P-3S, P-3I, and P-3D.

In addition, groundwater samples were obtained from four off-Site groundwater monitoring wells designated as MW-1, MW-2, MW-3, and MW-6 that were installed by Interstate Container Corporation to assess groundwater quality on their property to the south of the Baldwin facility.

Subsequent to completing the installation of the monitoring wells, a second groundwater monitoring event was conducted in September 2004. During this event, groundwater samples were obtained from the newly installed monitoring wells and from the wells and piezometers sampled in March 2004. A description of the methods and procedures used to obtain the groundwater samples during each sampling event is presented below.

4.6.2 Water-Level Measurements

Each groundwater sampling event included recording depth-to-water measurements from each monitoring well and piezometer. For each event, the groundwater measurements were recorded during a single day in accordance with LEA's *Standard Operating Procedure for Low Flow (Low Stress) Liquid Sample Collection and Field Analysis*. At each monitoring well and piezometer, the depth-to-water was measured to the nearest 0.01 foot using a decontaminated electronic water-level indicator. Manual water-level measurements were made by slowly lowering the indicator probe into the monitoring well or piezometer until the device indicated that the water surface had been reached. The depth to water was read from the calibrated cord suspending the probe as referenced from the top-of-casing. Each measurement was recorded on the field paperwork. The depth-to-water measurements were used in calculating the water table elevation at each monitoring well and piezometer location by subtracting the measured depth-to-

water from the known top-of-casing elevation. The depth-to-water and groundwater elevation data were used to calculate vertical gradients and to develop groundwater contours that were used to evaluate groundwater flow at the Site.

4.6.3 Groundwater Sampling

For each sampling event, groundwater samples were obtained using low-flow, low-stress groundwater sampling techniques in accordance with LEA's *Standard Operating Procedure for Low Flow (Low Stress) Liquid Sample Collection and Field Analysis*. This procedure was used to obtain unfiltered samples to properly assess groundwater quality at the Site. The sampling procedure is generally summarized below.

Once the depth-to-water level measurement was obtained, a bladder pump and dedicated tubing were deployed within the well or piezometer. The pump was set within the mid-section of the screened interval or open borehole of the well or piezometer. Using the bladder pump, groundwater was purged from the well or piezometer through a flow-through cell and measurements of pH, temperature, specific conductance, dissolved oxygen, and oxidation-reduction potential (eH) were recorded. The turbidity of the purged groundwater was also recorded. These field parameters were recorded approximately every three to five minutes until the parameters stabilized. Stabilization was considered to be achieved when three consecutive readings taken at three to five minute intervals were within the following limits: specific conductance ($\pm 3\%$); temperature ($\pm 3\%$); turbidity ($\pm 10\%$); dissolved oxygen ($\pm 10\%$); and pH ± 0.1 units.

Attempts to obtain groundwater samples from piezometers P-2, PZ-10D, PZ-70I were unsuccessful due to either an obstruction or breach in the piezometers. Groundwater samples obtained from piezometers P-3I, P-4D, PZ-20D and PZ-20I during the March 2004 sampling event were filtered with 10-micron filters due to high turbidity readings.

The groundwater samples were placed into pre-preserved bottles, as appropriate, upon being collected. The samples were containers were then placed and secured within a cooler along with appropriate chain-of-custody documentation, pending transportation to the analyzing laboratory.

The groundwater samples were submitted to AEL to be analyzed for the presence of VOCs, Resource Conservation and Recovery Act (RCRA) 8 metals plus copper, nickel, zinc, and total cyanide. The groundwater samples were also analyzed for hexavalent chromium by Lancaster Laboratories, Inc. of Lancaster, Pennsylvania.

4.7 Aquifer Response to Production Well Pumping

To assess contaminant transport and hydraulic control along the downgradient property boundary, groundwater elevations were measured following the collection of the groundwater samples in September 2004. The groundwater elevations were recorded for both pumping and non-pumping conditions. The elevations were recorded using pressure transducers deployed in select monitoring wells and piezometers, namely: OW-2, MW-03, MW-04, MW-05S, MW-05I, MW-05D, MW-06, MW-07S, MW-07D, MW-08, MW-08S, MW-08D, P-4S, P-4I, P-4D, P-5S, P-5D, PZ-30S, PZ-30I, PZ-30D, PZ-40S, PZ-50S, PZ-50I, and PZ-50D. The pressure transducers were set within the well or piezometer to an approximate depth of 15 feet below the water table. Once deployed, the pressure transducers recorded changes in the water table elevation while the production wells were pumping. The Site production wells were turned off for a period of approximately eight hours while the pressure transducers recorded the changes in water table elevation. Pumping conditions were then resumed while the pressure transducers continued to record the changes in water table elevation. Groundwater elevations were recorded to identify any influence in the surrounding monitoring wells due to the cessation and subsequent resumption in pumping conditions. Aquifer response graphs are presented in Appendix E.

4.8 Management of Investigation-Derived Waste

During the Phase II/III activities, all investigative-derived wastes (IDW) that were generated were placed into appropriate containers and were properly labeled. The IDW included soil drill cuttings generated during the advancement of soil borings, as well as monitoring well development, testing and purge water. The IDW also included decontamination fluids.

The IDW generated from the advancement of soil borings were placed into two 55-gallon drums and two 20-cubic yard (cy) roll-off containers. The IDW generated from monitoring well development, testing, and purge water were placed into a 21,000-gallon frac tank. The IDW generated during the decontamination of field equipment was also placed within this frac tank.

All IDW was stored on-site pending characterization and transportation to an off-site disposal facility. Samples were obtained for laboratory analysis in characterizing the IDW. The specific laboratory testing performed on the samples to characterize the waste streams was defined by the disposal facility. QA/QC and Data Management Measures.



5. QA/QC AND DATA MANAGEMENT

5.1 Overview

During the course of the Phase II/III investigation, a significant amount of data and information were obtained and recorded for the Site. The data include analytical data for soil vapor, soil, and groundwater samples. The information includes information recorded on geologic boring logs, monitoring well construction logs, and field reporting forms. In obtaining and recording the data and information, the need to maintain accurate and complete documentation through each phase of the investigation was a paramount concern in meeting the data quality objectives (DQOs) for the Site. Therefore, standard QA/QC measures and data management procedures were implemented during the investigation. A description of these measures and procedures is provided in this section, following a description of the DQOs for the Site.

5.2 Data Quality Objectives

The CSM was used to identify the data needed to fill existing information gaps and to define the scope of the Phase II/III investigation activities that result in the acquisition of data that satisfy the stated purpose of the investigation. A DQO process was employed to fill these data needs. DQOs are designed to ensure that the type, quantity, and quality of data used in the decision making process are appropriate for the intended application. For the investigation activities, the DQO process is summarized below.

In general, two types of data were used during the Phase II/III investigation activities: field data and laboratory analytical data. Field data were collected using portable field equipment to select samples for laboratory analytical confirmation and to preliminarily define areas of contamination. The field data included soil vapor and soil PID screening results. These data also included field portable GC results of soil vapor, soil, and groundwater samples, as well as physical data including groundwater pH, temperature, specific conductance and turbidity. Based on the field data obtained, the need for further additional Site characterization was evaluated. During the investigation, field data also included the results of monitoring for health and safety compliance.

Laboratory analytical data were used to support scientifically and legally defensible Site decisions. In general, the laboratory analytical data were used to verify the soil vapor, soil, and groundwater contamination. During the investigation, laboratory analytical data were also used to characterize material for waste management and disposal purposes. Specifically, the laboratory analytical data were used to evaluate (i) concentrations of contaminants-of-concern;

(ii) the need for further investigation or the implementation of remedial measures; and (iii) waste management and disposal requirements.

To ensure the quality of the field and laboratory data, the QA/QC procedures presented in this section were employed during the Phase II/III investigation.

5.3 **Standard Operating Procedures**

In conducting the Phase II/III Site investigations, general investigative tasks were conducted in accordance with LEA's SOPs. With regard to field sampling of various environmental media, the SOPs take into account the need for precision, accuracy, completeness, representativeness, and comparability of data. Although it is understood that there are limits on data accuracy and precision that are inherent in the collection and analysis of samples and in the operation of measuring devices, adherence to SOPs increases the consistency of the data being collected and evaluated.

Adherence to the SOPs also increases the level of confidence in satisfying the DQOs and objectives of the investigation. Data evaluation is also dependent upon the representativeness of the samples or measurements collected and the completeness of information associated with collection of the data. Collection and measurement techniques identified in the SOPs have been designed to take these factors into account, thus increasing the level of confidence that can be placed in the data.

Understanding that adherence to SOPs is imperative for the successful completion of any investigation, there will be instances where exceptions to the SOPs must be made to obtain reliable data. When exceptions are made, documentation of both the situation requiring deviation and the actual deviation in procedure was recorded in the field documentation.

Each SOP was developed by personnel experienced in the performance of the specific activity. At least two senior-level people, one the Director of Quality, reviewed the SOP to ensure that the identified procedures satisfy the stated objectives and that the prescribed procedures are technically correct, appropriately applied, and in conformance with applicable regulatory criteria and standard practices. These individuals signified their approval by signing and dating the SOP. The LEA SOPs that were used in conducting the Phase II/III activities are provided in Appendix A and include:

- *Standard Operating Procedure for Soil Vapor Surveying*
- *Standard Operating Procedure for Modified EPA Method 3810 Static Headspace Analysis of Volatile Organic Compounds Using the Photovac® 10S50 Gas Chromatograph*

- *Standard Operating Procedure for Geoprobe® Probing and Sampling*
- *Standard Operating Procedure for Hand Auger Borings*
- *Standard Operating Procedure for Soil Sampling*
- *Standard Operating Procedure for Geologic Logging of Unconsolidated Sedimentary Materials*
- *Standard Operating Procedure for Test Pit Sampling*
- *Standard Operating Procedure for Quality Assurance/Quality Control Measures for Field Activities*
- *Standard Operating Procedure for Installing & Developing Monitoring Wells and Piezometers*
- *Standard Operating Procedure for Low Flow (Low Stress) Liquid Sample Collection and Field Analysis*

5.4 Use and Maintenance of Field Equipment, Instrumentation, and Materials

Field quality assurance (QA) procedures begin with the use and maintenance of all field equipment and instrumentation and include the proper calibration of the equipment. All field equipment and instruments were operated and maintained in a manner that is consistent with the manufacturer's recommended practices. Any deviations from standard use of the equipment or required repairs or adaptations made in the field were noted in the field documentation. Operation and maintenance manuals for all equipment were kept in a single location that was known and accessible to all personnel likely to use the equipment. Field personnel either returned equipment in a condition that permitted its optimal use on the following day of field operations, or notified the appropriate personnel so that repairs and/or replacements could be arranged in an expedient fashion.

5.5 Calibration of Field Equipment and Instrumentation

Instruments and equipment were calibrated with sufficient frequency, and in such a manner, that accuracy and reproducibility of results were consistent with the appropriate manufacturer's specifications. Calibration was performed at intervals recommended by the manufacturer or more frequently, as conditions dictated. Field instruments that required calibration included: field portable GCs, PIDs, turbidity meters, and pH, specific conductance, and dissolved oxygen meters. Documentation that the field instruments were calibrated was provided in the field documentation.

5.6 Sample Identification

Each sample that was collected was assigned a unique seven-digit sample identification number. This number was used to track the sample in a computer-based sample tracking system. In addition to this tracking number, each sample was assigned a unique alpha-numeric sample location designation that is cross-referenced to the sample-specific identification (tracking) number. Each sample location designation is based on a systematic naming convention that prevents duplication of sample location names. The nomenclature used to identify sample locations provides a relatively easy means of finding the referenced locations on Site drawings.

For soil samples obtained at the Site, the alpha-numeric sample location name is based on: (i) the type of sample; (ii) the area of concern or REC from which the sample was obtained; a sequential number representing the location for the REC; and a sequential number for the sample obtained from the REC location. The type of samples obtained during the Phase II/III investigation include soil vapor survey samples (VP); soil vapor samples for laboratory analytical confirmation (SV); surface soil samples (SS); subsurface soil samples obtained from soil borings (SB), and groundwater samples obtained from monitoring wells, production wells, and piezometers (MW, OW, PW, PS, P, PZ). Using the prescribed nomenclature, the first surface soil sample obtained from the second location for REC 06 would be identified as SS-06-02-01, where:

- “SS” – The first two letters indicate the sample type, in this case a surface soil sample;
- “06” - The next pair of numbers indicates the REC designation, in this case REC 06 (dust handling and storage areas);
- “02” – The next designation indicates a specific location for the associated REC, in this case, the second location identified for REC 06; and
- “01” – The final pair of numbers indicates the first sample obtained for this REC location, in this case the first sample in area 02 for REC 06.

Similarly, the first subsurface soil sample obtained from the third location for REC 04 (former and existing vapor degreaser areas) would be identified as SB-04-03-01, where:

- “SB” – The first two letters indicate the sample type, in this case a subsurface soil sample;
- “04” - The next pair of numbers indicates the REC designation, in this case REC 04 (former and existing vapor degreaser areas);
- “03” – The next designation indicates a specific location for the associated REC, in this case, the third location identified for REC 04; and

- “01” – The final pair of numbers indicates the first sample obtained for this REC location, in this case the first sample in area 03 for REC 04.

For soil vapor samples obtained at the Site, the alpha-numeric sample location name is based on: (i) the type of sample; and (ii) the node of the soil vapor survey grid from which the sample was obtained, or the building number for the soil vapor samples obtained for laboratory analytical confirmation; and, in the case of soil vapor samples obtained for laboratory analytical confirmation, a sequential number for the sample obtained from the building. Using the prescribed nomenclature, the soil vapor survey sample obtained from grid node D04 would be identified as VP-D04, where:

- “VP” – The first two letters indicate the sample type, in this case a soil vapor survey probe sample; and
- “D04” - The next designation indicates the node of the soil vapor survey grid from which the sample was obtained.

Using the prescribed nomenclature, the fifth soil vapor sample obtained for laboratory analytical confirmation from Building 3 would be identified as SV-03-05, where:

- “SV” – The first two letters indicate the sample type, in this case a soil vapor sample;
- “03” - The first pair of numbers indicates the building number; and
- “05” – The second pair of numbers indicates the fifth soil vapor sample obtained from this building.

For the groundwater monitoring wells installed during the Phase II/III investigation, the wells are designated with the “MW” prefix followed by the well number; for example, MW-02. For the monitoring wells installed as part of a well cluster, the well designation may also include a suffix to identify the relative depth of the well within the cluster; “S” for shallow, “I” for intermediate, and “D” for deep. For the wells and piezometers installed prior to the Phase II/III investigation, the wells and piezometers are identified with either the “MW”, “OW”, “P”, “PS”, “PW”, or “PZ” designations. For the wells installed as part of a well cluster, the well designation also includes the “S”, “I”, or “D” suffix.

For the groundwater samples obtained during the Phase II/III investigation, the alpha-numeric designation is based simply on the well or piezometer designation. For instance, a groundwater sample obtained from monitoring well MW-04 would be assigned the sample location identifier “MW-04”. Similarly, a groundwater sample obtained from piezometer PZ-40S would be

assigned the sample location identifier “PZ-40S”, and a groundwater sample obtained from observation well OW-2 would be assigned a sample location identifier “OW-2”.

5.7 Sample Tracking

Field sample tracking activities focused on the timely assignment and tracking of information for every field sample obtained during the investigation. This information included the identification of samples, the identification of sampling locations, sample chain-of-custody information, and information pertaining to sample physical characteristics. The specific sample tracking, sample collection, and sample preservation procedures that were followed during the Phase II/III investigation are discussed in greater detail below.

In general, each sample obtained during the investigation was identified with the following sample-specific information:

- site location;
- date and time;
- sample matrix;
- sample type;
- sample number; and,
- sample depth interval (where applicable).

This information was conveyed from field to office personnel on daily field summary report forms, accompanying field forms, and chain-of-custody forms.

A computer-based sample-tracking system, based on a dBase[®] database computer program, was used for sample tracking. Field sample tracking included the following tasks:

- assignment of a unique seven-digit sample identification number and other sample identifiers to new samples to be taken, and entry into the tracking system;
- production of sample bottle labels from the tracking system;
- completion of chain-of-custody forms, and entry of this information into the tracking system;
- entry of additional tracking dates into the tracking system;
- QA checks of the sample tracking information, and processing requested corrections; and

- production of tracking reports and summary sheets, with distribution to appropriate project staff.

5.8 Sample Labeling, Sample Shipping, and Chain-of-Custody Documentation

For each sample obtained in the field, a sample label generated by the computer-based sample tracking system was affixed to the sample container. The sample labels included the seven-digit sample identification number that is unique to the sample. The labels also identified the project number and the analyses for which the sample was to be analyzed. The date and time that the sample was collected was entered onto the label by field personnel.

Once the samples were obtained and the sample containers were labeled, the sample containers were placed in coolers packed appropriately to avoid bottle breakage. Either freezer packs or wet ice packed in zip-locked bags were placed in the coolers to keep the samples at a temperature not exceeding 4° Celsius during transport to the laboratory. Samples were transported to the analyzing laboratory by courier under proper chain-of-custody documentation.

The information recorded on each sample label was also recorded on the chain-of-custody form accompanying the sample. The samples obtained in the field were identified on the sample container labels and on the chain-of-custody forms only by the unique seven-digit sample identification number assigned to the sample. The chain-of-custody documentation procedures were followed to create an accurate written record that could be used to trace the possession of the samples from the time that the sample was collected until it was analyzed. The specific chain-of-custody procedures that were followed during the Phase II/III investigation are described in the *LEA Standard Operating Procedure for Quality Assurance/Quality Control Measures for Field Activities* (Appendix A).

5.9 Field Documentation

During the course of the Site investigation activities, the field personnel maintained a daily record of events on a daily field summary report form. The daily field summary report provides a detailed description of the samples obtained by field personnel and includes a summary of daily activities including the hours on-site, general field observations, weather conditions, field instrumentation QA record, IDW management record, problems and problem resolutions, and any departures from the planned activities or SOPs that occurred during the course of the field activities. Entries on the daily field summary report forms were recorded in waterproof ink and each page was consecutively numbered for each sampling day. Each daily field summary report included the following information:

- the name of person recording information;
- the names of all field personnel;
- the project name and number;
- the date;
- the starting and ending times for the field activities;
- the weather conditions;
- the equipment used;
- the samples collected;
- the field parameters measured; and
- the results of any equipment calibration that was performed.

The daily field summary reports were supplemented with sampling logs, boring logs, monitoring well construction logs, and chain-of-custody forms. Boring logs include a description of the lithology, sample recovery data, drilling method, sample collection information, VOC screening results, and pertinent notes regarding drilling conditions. The monitoring well construction logs include such information as the screened interval for the well, the types and depths of the filter pack and bentonite seals, and the type of wellhead completion.

Any corrections made in the field reports were crossed out, not erased, and were initialed by the person making the correction. Each page of the field documentation was signed by the person responsible for recording information on that day. All lines on a page, and all pages, were used or crossed out and initialed.

Copies of the field summary report forms and accompanying documentation including sampling logs, boring logs, and chain-of-custody forms, were submitted to the field activities coordinator at the end of each working day, or as soon thereafter as possible. In addition, the original field report forms were maintained onsite in loose-leaf three-ring binders for reference by field personnel and until the forms could be placed in the central project file.

5.10 **Quality Assurance/Quality Control Samples**

5.10.1 Overview

To meet the DQOs and stated objectives for the Site investigation, a number of QA/QC samples were obtained during the field sampling activities. The samples were obtained in accordance

with LEA's *Standard Operating Procedure for Quality Assurance/Quality Control Measures for Field Activities*. The QA/QC samples that were obtained included field duplicate samples which were used to provide: (i) a measurement of the consistency of samples obtained from the same sample location; and (ii) an estimate of sampling variance and bias. The QA/QC samples that were obtained also included trip and field equipment rinsate blanks. The trip blank provides a means to assess cross-contamination sources, and the field equipment rinsate blank provides a means to assess the adequacy of field decontamination efforts. A more detailed description of the field QA samples obtained and analyzed during the Phase II/III investigation is provided below.

5.10.2 Field Duplicate Samples

A duplicate is a quality control (QC) sample that is used to assess the precision associated with all or part of the sample collection and measurement process. Field duplicates are used to assess the precision associated with the entire sample collection and measurement process. Field duplicates are two independent samples which are collected, as nearly as possible, from the same point in space and time. The two field duplicate samples are collected from the same source, using the same type of sampling equipment. Each field duplicate is collected and stored in separate sample containers and transported in the same shipping container.

Duplicate samples were obtained for each medium sampled: soil vapor, soil, and groundwater. As presented in Section 5.6, the samples were identified with a unique seven-digit sample identification (tracking) number so as to not identify the samples as QA samples to the analyzing laboratories. In accordance with the SOP, field duplicate samples were obtained at a rate of one duplicate per 20 field samples obtained.

5.10.3 Trip Blank Samples

Trip blank samples are used to identify the presence of VOC contamination attributable to transfer across a sample container septum during shipping and storage of samples. A trip blank is a sample of analyte-free matrix that is transported from the laboratory to the sampling site with the sample containers. The trip blank is stored on-site with the sample containers and field samples and then transported back to the laboratory with the samples for analysis. The trip blank is received and processed as a sample by the laboratory. Trip blank samples were prepared by AEL as part of the soil and groundwater sampling activities. These samples were provided by AEL along with the soil and groundwater containers to be used in collecting soil and groundwater samples for VOC analyses. A trip blank sample was included in each shipment of soil and groundwater samples to be analyzed for VOCs.

5.10.4 Equipment Rinsate Blank Samples

An equipment rinsate blank is a sample of analyte-free water that is poured over or through decontaminated field sampling equipment that is considered to be ready for collecting or processing field samples. The purpose of the equipment rinsate blank is to assess the adequacy of the decontamination process. Equipment rinsate blank samples were obtained as part of the soil and groundwater sampling activities. One equipment rinsate blank sample was obtained per day for each sampling method used. These samples were submitted to the laboratories for the same analyses as the field samples.

5.11 Field Equipment Decontamination

All field equipment and materials that were used during the Phase II/III investigation consisted of clean, disposable materials or were decontaminated prior to initiating investigation activities. The field equipment decontamination procedures are included in the SOPs presented in Appendix A. These procedures were followed to prevent the extraneous introduction of contamination at a sampling location.

For hand-held tools and equipment, the field decontamination process involved the use of a portable decontamination system consisting of a small, portable trough to contain over-spray and potentially spilt decontamination fluids and decontamination solutions in individual 5-gallon buckets, or spray containers, as appropriate. In general, the sampling equipment was decontaminated using the following procedure:

- brush off gross soil particles;
- wash and scrub equipment with phosphate-free detergent;
- rinse equipment with deionized water;
- rinse equipment with dilute nitric acid solution;
- rinse equipment in deionized water;
- rinse equipment with dilute methanol/water solution;
- rinse equipment in deionized water; and
- allow equipment to air dry.

For test pit excavation and drilling equipment, the field decontamination process involved the use of both dry and wet decontamination methods. A temporary decontamination pad was constructed at the Site to facilitate the decontamination process. This temporary pad was constructed of polyethylene sheeting and straw bales. The temporary pad was constructed over a natural depression in the ground that served as a sump for the collection of decontamination fluids. The dry decontamination process involved brushing soil particles off of the equipment. The wet decontamination process involved steam cleaning the equipment with a high-pressure steam cleaner.

Fluids generated during the decontamination of hand-held equipment were collected in five-gallon buckets and were transferred to the frac tank on a daily basis. Fluids generated during the decontamination of the large equipment were collected on the polyethylene sheeting of the temporary decontamination pad. These fluids were transferred to the frac tank on a daily basis. Solids that were generated from the field decontamination process were collected in five-gallon buckets or on the polyethylene sheeting of the temporary decontamination pad. These solids were transferred to either 55-gallon drums or the 20-cy roll-off containers on a daily basis.

5.12 Database Management

5.12.1 Data Entry

The field personnel performed an initial review of data obtained from field measurements. This review consisted of checking procedures utilized in the field, ensuring that field measurement instruments were properly calibrated, verifying the accuracy of transcriptions, and comparing data obtained in the field to historic measurements. Field records were subsequently reviewed following completion of each day's field activities for completeness and consistency. Once entered into this system the field documentation was verified to ensure that all of the information was transferred correctly.

An internal review of analytical data was the responsibility of laboratory personnel. The analyst initiated the data review process by examining and accepting the data. The data reviewer then reviewed the completed data package. The data reviewer provided a technical review for accuracy and precision according to the methods employed and to the laboratory protocols. The data package was also reviewed for completeness, ensuring that all pertinent information was reported, all appropriate forms were signed and dated, all calculations were performed correctly, and all holding times and QC sample acceptance criteria were met). A final review of the data was provided by the Project Manager to ensure that the data package met the project specifications.

The information and data obtained from the investigations conducted as part of the Phase II/III activities were then entered into the computer-based tracking system (electronic database). This information and data included field data, survey data, and laboratory analytical data. The information and data recorded on the field summary reports, sampling logs, boring logs, monitoring well construction logs, and chain-of-custody forms, including field measurements and the identification and location of field samples, were transferred manually into the electronic database. The information and data that were recorded on the field forms were entered into the database on a daily basis. In addition, all survey information was provided by L. Robert Kimball & Associates, Inc. in an electronic format. This information was entered into the electronic database and was used to generate the AutoCAD® drawings and base maps that illustrate the information and data presented in this report. All laboratory analytical data were provided in both paper and electronic format. The laboratory data that were provided in electronic format were down-loaded directly into the database as soon as they were received.

5.12.2 Data Verification

As soon as any information and data were entered into the electronic database, a data-read file was printed from the database. The data were then verified by manually checking the accuracy of the data-read file with the data recorded on field reports and paper copies of the laboratory analytical reports. The verification of the field data included a review of sample identification and sample location information to ensure that all of the sampling data were entered correctly. The verification of the laboratory analytical data included a review of the analytical data to ensure that the data for all samples were entered correctly and that all of the requested analytical procedures had been performed. As part of the data verification process, any discrepancies between the electronic data-read file and the paper copies of the field and laboratory data were noted on the data-read file. The appropriate corrections were then made to the data stored in the electronic database. The data that were corrected were subsequently re-checked to verify the accuracy of the information stored in the database.

6. RESULTS OF INVESTIGATION

6.1 Overview

The results of the field investigations conducted as part of the Phase II/III activities are presented in this section. The results that were obtained include field measurements collected during sampling of various media, as well as data obtained from the borehole geophysical logging and packer testing. The results also include sample laboratory analytical data.

6.2 Soil Vapor Sampling Results

6.2.1 Soil Vapor Survey Results

A list of the soil vapor probe samples that were obtained and analyzed as part of the Site-wide soil vapor survey is provided in Table 6-1. A summary of the VOCs detected in these samples is provided in Table 6-2. As shown in Table 6-2, the primary VOC present within the subsurface is TCE. Of the 312 samples that were analyzed, 200 samples were reported to contain detectable concentrations of TCE. At a few locations, other VOCs including benzene, TCA, PCE, and toluene were detected.

The soil vapor survey results are illustrated in Drawing 4-1. The soil vapor probe sample locations are illustrated in this drawing. The concentrations of TCE reported for each soil vapor probe sample are also illustrated. As shown in the drawing, four primary areas were identified as possible sources of the VOCs, primarily TCE, detected within the subsurface. These areas are identified as:

- the area adjacent to the TCE vapor degreaser in Building 3, where the highest concentration of TCE was reported to be 42,000 milligrams per cubic meter (mg/m^3) at soil vapor sample location VP-G02;
- the area of Building 51 and Building 51A, where the highest concentration of TCE was reported to be 360 mg/m^3 at soil vapor sample location VP-P14;
- the area west of the TCE vapor degreaser in Building 12, where the highest concentration of TCE was reported to be 1,200 mg/m^3 at soil vapor sample location VP-H18; and
- the area immediately north of Building 8, where the highest concentration of TCE was reported to be 1,700 mg/m^3 at soil vapor sample location VP-C10.

The soil vapors within these areas contain elevated levels of TCE. The limits of the elevated levels of TCE are approximated by the TCE isoconcentration contours depicted in the drawing.

6.2.2 Results of Additional Soil Vapor Sampling

A list of the additional soil samples that were obtained to further assess the presence of VOCs in soil gas is provided in Table 6-3. A summary of the VOCs detected in these samples is provided in Table 6-4. As shown in Table 6-4, a number of VOCs were detected in these samples, including: 1,1 dichloroethane; 1,1 dichloroethylene; 1,3,5-trimethylbenzene; 1,2,4-trimethylbenzene; 4-ethyltoluene; acetone; benzene; carbon disulfide; cis-1,2-dichloroethylene; chloroform; dichlorodifluoromethane; ethanol; isopropanol; methylene chloride; methyl ethyl ketone; n-heptane; n-hexane; PCE; TCA; TCE; tetrahydrofuran; toluene; trichlorofluoromethane; meta-xylene; ortho-xylene; and para-xylene.

The laboratory analytical results confirm that the primary VOC detected during soil vapor survey in the subsurface is TCE. For each area assessed within Buildings 3, 12, and 51, TCE was reported to be present at the highest concentration for all of the VOCs that were detected. The greatest concentration of TCE was reported for samples obtained adjacent to the existing TCE vapor degreaser. A maximum TCE concentration of 10,000 mg/m³ was reported in sample SV-03-02.

6.3 Soil Sampling Results

6.3.1 Overview

As presented in this section, the soil sampling and analytical results are summarized by the REC identified during the Phase I ESA. The specific areas of concern identified for each REC are addressed within the discussion of the results. The discussion of results includes details pertaining to the number of samples obtained, the depth from which the samples were obtained, the number of samples analyzed, and the analytical results of the samples analyzed.

A summary of soil sampling and analytical information is provided in Table 6-5. A summary of the mass data for the constituents detected in all soil samples obtained and analyzed is provided in Table 6-6. Based on a review of the mass data summarized in this table, select soil samples were subsequently analyzed for metals and/or SVOCs following the SPLP. A summary of the SPLP soil sampling and analytical information is provided as Table 6-7. A summary of the constituents detected using the SPLP is included as Table 6-8. The locations of all soil samples including surface soil samples and the soil samples obtained from soil borings and excavated test

pits are illustrated in Drawing 6-1 (Sheets 1 - 8). The laboratory results for the constituents detected in the samples that were analyzed are also illustrated in this drawing.

6.3.2 REC 02 – Plating and Chemical Strip Lines

6.3.2.1 Overview

This REC encompasses the former and existing plating lines at the facility. Specifically, this REC addresses ten locations: (i) the plating line in Building 7; (ii) the lacquer strip line in Building 9; (iii) the chemical strip line in Building 9; (iv) the chemical strip line in Building 10; (v) the plating line in Building 11; (vi) the chemical strip line in Building 51; (vii) the chemical strip line in Building 51A; (viii) the plating line Building 50; (ix) the plating line in Building 9; and (x) and the former plating line Building 9.

6.3.2.2 Plating Line -Building 7

Two soil borings (SB-02-01-01 and SB-02-01-02) were advanced to provide an initial assessment of subsurface conditions within the area of the plating line in Building 7. The locations of these borings are illustrated on Sheet 2 of Drawing 6-1. These two borings were advanced to depths of 3.75 and 11 feet bgs, respectively. A total of 8 soil samples were collected from the borings. The samples were analyzed by the LEA laboratory for the presence of select VOCs. Based on the field GC results, four soil samples were selected to be analyzed at AEL for VOCs, metals and total cyanide. The samples that were selected for analysis by AEL include the samples obtained from the 0 to 2' and the approximate 2 to 4' intervals of each boring. The sample obtained from a depth of 2 to 4' from soil boring SB-02-01-01 was also selected for analysis of metals using the SPLP.

Based on the laboratory results, VOCs including acetone, ethylbenzene, TCE, toluene, and xylenes were detected in the samples that were submitted for analysis. The highest concentration of TCE (63 micrograms per kilogram ($\mu\text{g/kg}$)) was reported for the sample obtained from a depth of 2 to 4' from soil boring SB-02-01-02. Based on the laboratory results, a number of metals were also detected in the four samples that were analyzed. However, none of the metals were detected in the SPLP analysis. Total cyanide was not detected in any of the soil samples analyzed.

6.3.2.3 Lacquer Strip Line - Building 9

Three soil borings (SB-02-02-01 through SB-02-02-03) were advanced to provide an initial assessment of subsurface conditions within the area of the lacquer strip line in Building 9. The three soil borings were advanced to depths of 4 feet bgs, 4 feet bgs, and 8 feet bgs, respectively.

A total of 9 soil samples were collected and analyzed by the LEA laboratory for the presence of select VOCs. Based on the field GC results, eight soil samples were selected to be analyzed at AEL for VOCs, metals and total cyanide. The samples that were selected for analysis by AEL include the samples obtained from the 0 to 2' and the approximate 2 to 4' intervals for each of the borings and from the 4 to 6' interval in soil boring SB-02-02-03. The sample obtained from a depth of 4 to 6' from soil boring SB-02-02-03 was also selected for analysis of metals using the SPLP.

Concentrations of VOCs were reported for seven of the eight samples analyzed. No VOCs were reported to be present in the sample obtained from the 0 to 2' for soil boring SB-02-02-01. The highest concentration of TCE (18 µg/kg) was reported for the sample obtained from a depth of 4 to 6' from soil boring SB-02-02-03. Based on the laboratory results, a number of metals were also detected in each of the soil samples analyzed. However, no metals were detected in the SPLP analysis. Based on the laboratory results, total cyanide was not detected in any of the soil samples analyzed.

6.3.2.4 Chemical Strip Line - Building 9

Three soil borings (SB-02-03-01 through SB-02-03-03) were advanced to provide an initial assessment of subsurface conditions within the area of the chemical strip line in Building 9. The three soil borings were advanced to depths of 2 feet bgs. A total of three soil samples were collected and analyzed by the LEA laboratory for the presence of select VOCs. Based on the field GC results, each sample was selected to be analyzed at AEL for VOCs, metals and total cyanide.

Based on the AEL laboratory analytical results, VOCs were not detected in the three samples analyzed. Additionally, cyanide was not detected in any of the samples. However, as provided in Table 6-6, a number of metals were detected in each sample.

6.3.2.5 Chemical Strip Line - Building 10

Two soil borings (SB-02-04-01 and SB-02-04-02) were advanced to provide an initial assessment of subsurface conditions within the area of the chemical strip line in Building 10. The two soil borings were advanced to depths of 2.5 and 2 feet bgs, respectively. A total of three soil samples were collected and analyzed by the LEA laboratory for the presence of select VOCs. Based on the field GC results, each sample was selected to be analyzed by AEL for VOCs, metals and cyanide. The samples that were selected for analysis by AEL include the samples obtained from the 0 to 2' interval for soil boring SB-02-04-01 and the 0 to 2.5' interval for soil boring SB-02-04-02.

Based on the AEL laboratory analytical results, a number of VOCs, including acetone, TCE, toluene, and xylenes were detected at estimated concentrations within the sample obtained from a depth of 0 to 2.5' at soil boring SB-02-04-01. Concentrations of TCE (15 µg/kg) and toluene (98 µg/kg) were reported to be present within the sample obtained from a depth of 0 to 2' at soil boring SB-02-04-02. Based on the laboratory results, a number of metals were also detected in each of the samples analyzed. Total cyanide was not detected in any of the samples, as reported by AEL.

6.3.2.6 Plating Line - Building 11

Four soil borings (SB-02-05-01 through SB-02-05-04) were advanced to provide an initial assessment of subsurface conditions within the area of the plating line in Building 11. The four soil borings were advanced to depths between 4 feet bgs and 12 feet bgs. A total of 16 soil samples were obtained and analyzed by the LEA laboratory for the presence of select VOCs. Based on the field GC results, a total of 11 soil samples were selected to be analyzed by AEL for VOCs, metals and total cyanide. The samples that were selected for analysis by AEL include the samples obtained from the 0 to 2' interval at each boring and from the 8 to 10' and 10 to 12' intervals at soil boring SB-02-05-03.

Based on the AEL laboratory analytical results, a number of VOCs, including ethylbenzene, TCE, and xylenes were detected at estimated concentrations within the samples obtained from a depth of 0 to 2' at soil boring SB-02-05-01 and from depths of 0 to 2' and 2 to 4' at soil boring SB-02-05-04. No other VOCs were detected. As shown in Table 6-6, concentrations of metals were reported for each of the samples analyzed. Total cyanide was not detected in any of the soil samples analyzed.

6.3.2.7 Chemical Strip Line - Building 51

Four soil borings (SB-02-06-01 through SB-02-06-04) were advanced to provide an initial assessment of subsurface conditions within the area of the chemical strip line in Building 51. The four soil borings were advanced to depths between 2 feet bgs and 12 feet bgs. A total of 12 soil samples were obtained and analyzed by the LEA laboratory for the presence of select VOCs. Based on the field GC results, a total of seven soil samples were selected to be analyzed by AEL. The samples that were selected for analysis include the samples obtained from: the 0 to 2' interval for all four borings (0 to 3.8' for SB-02-06-02); the 6 to 8' and 8 to 10' intervals at soil boring SB-02-06-01; and the 2 to 4' interval at soil boring SB-02-06-03. These samples were analyzed for VOCs, metals and total cyanide. In addition, two samples observed in the field to be representative of fill material were also analyzed for SVOCs and TPH.

Based on the AEL laboratory analytical results, acetone was detected at a concentration of 140 µg/kg in the samples obtained from the 0 to 3.8' sampling interval at soil boring SB-02-06-02 and the 2 to 4' sampling interval at soil boring SB-02-06-03. Carbon Disulfide was also reported to be present at a concentration of 14 µg/kg in the sample obtained from soil boring SB-02-06-02. Based on the laboratory results, TCE (51µg/kg) was also detected in this sample. Other than at estimated concentrations, no other VOCs were detected in the samples analyzed. Metals were detected in each sample analyzed. Based on the laboratory analytical results, SVOCs, TPH, and total cyanide were not detected in any of the samples.

6.3.2.8 Chemical Strip Line - Building 51A

Six soil borings (SB-02-07-01 through SB-02-07-06) were advanced to provide an initial assessment of subsurface conditions within the area of the chemical strip line in Building 51A. The soil borings were advanced to depths between 2 feet bgs and 16 feet bgs. A total of 23 soil samples were collected and analyzed by the LEA laboratory for the presence of select VOCs. Based on the field GC results, a total of 16 soil samples were selected to be analyzed by AEL.

The samples that were selected for analysis include the samples obtained from: the 0 to 2' interval for all six borings; the 2 to 4' intervals at soil borings SB-02-07-03 through SB-02-07-06; the 6 to 8' and 8 to 10' intervals at soil boring SB-02-07-03 and SB-02-07-05; and the 14 to 16' interval at SB-02-07-03. These samples were analyzed for VOCs, metals and total cyanide. In addition, four samples observed in the field to be representative of fill material were also analyzed for SVOCs and TPH.

Based on the AEL laboratory analytical results, TCE was detected at estimated concentrations within the samples obtained from soil borings SB-02-07-03, SB-02-07-05, and SB-02-07-06. In addition, a number of SVOCs were detected in the 2 to 4' sample obtained from soil boring SB-02-07-05. Metals were also detected in each sample analyzed. Based on the laboratory analytical results, TPH and total cyanide were not detected in any of the samples.

6.3.2.9 Plating Line - Building 50

Two soil borings (SB-02-08-01 and SB-02-08-02) were advanced to provide an initial assessment of subsurface conditions within the area of the plating line in Building 50. The two soil borings were advanced to depths of approximately eight feet bgs. A total of four soil samples obtained from the 0 to 2' and the 2 to 4' intervals of each boring were analyzed by the LEA laboratory for the presence of select VOCs. Based on the field GC results, each sample was selected to be analyzed by AEL for VOCs, metals and total cyanide. The samples obtained from

a depth of 0 to 2' at soil boring SB-02-08-01, and from a depth of 2 to 4' at soil boring SB-02-08-02 were also selected for analysis of metals using the SPLP.

Based on the AEL laboratory analytical results, VOCs were detected in all four samples analyzed. The highest concentration of TCE (110 µg/kg) was reported to be present in samples obtained from both soil borings. Metals were also detected in all four of the soil samples analyzed. However, no metals were detected in the SPLP analysis. Total cyanide was not detected in any of the soil samples.

6.3.2.10 Plating Line - Building 9

Three soil borings (SB-02-09-01 through SB-02-09-03) were advanced to provide an initial assessment of subsurface conditions within the area of the plating line in Building 9. The three soil borings were advanced to depths of approximately 2 feet bgs, 2 feet bgs, and 8 feet bgs, respectively. Three soil samples obtained from soil boring SB-02-09-03 were analyzed by the LEA laboratory for the presence of select VOCs. Due to insufficient soil volume, none of the samples obtained from soil borings SB-02-09-01 and SB-02-09-02 were analyzed using the field GC. Based on the field GC results, two samples were selected to be analyzed by AEL for VOCs, metals and total cyanide. The samples that were selected for analysis by AEL include the samples obtained from the 0 to 2' and 2 to 4' intervals at soil boring SB-02-09-03.

Based on the AEL laboratory analytical results, xylenes were detected at an estimated concentration of 6.3 µg/kg in the sample obtained from the 0 to 2' interval at SB-02-09-03. No other VOCs were detected. Metals were detected in each sample analyzed. Total cyanide was not detected in either sample.

6.3.2.11 Former Plating Line - Building 9

One soil boring (SB-02-10-01) was advanced to provide an initial assessment of subsurface conditions within the area of the former plating line in Building 9. The soil boring was advanced to a depth of six feet bgs. Two soil samples were obtained and analyzed by the LEA laboratory for the presence of select VOCs. Based on the field GC results, two soil samples were selected to be analyzed by AEL for VOCs, metals and total cyanide. The samples that were selected for analysis by AEL include the samples obtained from the 0 to 4' and 4 to 6' intervals.

Based on the laboratory analytical results, methyl ethyl ketone, TCE, and xylenes were detected at estimated concentrations. No other VOCs were detected in the samples analyzed. Metals were detected in both of the soil samples analyzed for soil boring SB-02-10-01. Total cyanide was not detected in either sample.

6.3.3 REC 03 - Former Sludge Drying Beds

This REC encompasses the two former sludge drying beds. The historic closure of the former drying beds included limited post-excavation sampling and analysis for metals only. This section is organized to provide a discussion of the results obtained for both Drying Bed #1, formerly located beneath Building 12, and Drying Bed #2, formerly located immediately south of Building 12.

6.3.3.1 Former Sludge Drying Bed #1

Three soil borings (SB-03-01-01 through SB-03-01-03) were advanced to provide an initial assessment of subsurface conditions within the former area of Sludge Drying Bed #1. The three soil borings were advanced to depths of 1.5 feet bgs, 4 feet bgs, and 1.5 feet bgs, respectively. Samples obtained from a depth of 0 to 2' and 2 to 4' at soil boring SB-03-01-02 were analyzed by the LEA laboratory for the presence of select VOCs. Due to insufficient soil volume, none of the samples obtained from soil borings SB-03-01-01 and SB-03-01-03 were analyzed using the field GC. Based on the field GC results, both samples from soil boring SB-03-01-02 were selected to be analyzed by AEL for VOCs, metals and total cyanide. The sample obtained from a depth of 0 to 2' at SB-03-01-02 was observed to be representative of fill material and therefore was also analyzed for SVOCs and TPH.

Based on the AEL laboratory analytical results, no VOCs were detected in either of the samples analyzed. Metals were detected in both of the soil samples. As provided in Table 6-6, SVOCs, TPH, and total cyanide were not detected in the soil sample obtained from the 0 to 2' interval at SB-03-01-02.

6.3.3.2 Former Sludge Drying Bed #2

Three soil borings (SB-03-02-01 through SB-03-02-03) were advanced to provide an initial assessment of subsurface conditions within the former area of Sludge Drying Bed #2. The three soil borings were advanced to depths of 8, 8, and 2.5 feet bgs, respectively. A total of eight soil samples obtained from the borings were analyzed by the LEA laboratory for the presence of select VOCs. Based on the field GC results, five soil samples were selected to be analyzed at AEL for VOCs, metals and total cyanide. The samples that were selected for analysis by AEL include the samples obtained approximately from the 0 to 2' intervals of all three borings, and the sample obtained from the 2 to 4' intervals at SB-03-02-01 and SB-03-02-02.

Based on the AEL laboratory analytical results, VOCs were detected in the sample obtained from the 2 to 4' interval at SB-03-02-01. Metals were detected in all five of the soil samples analyzed. As provided in Table 6-6, total cyanide was not detected in any of the soil samples analyzed.

6.3.4 REC 04 – Former and Existing Vapor Degreasers

This REC includes the existing and former locations of vapor degreasing operations (degreaser and ancillary structures) throughout the facility. Specifically, this REC addresses six locations: (i) the former vapor degreaser in Building 5; (ii) the existing TCE vapor degreaser in Building 3; (iii) the batch TCE vapor degreaser in Building 8; (iv) the batch TCE vapor degreaser in the northern portion of Building 12; (v) the TCE vapor degreaser in the southern portion of Building 12; and (iv) the former vapor degreaser area in Building 9. A description of the soil laboratory analytical results obtained for each location is provided below.

6.3.4.1 Former Degreaser - Building 5

Two soil borings (SB-04-01-01 and SB-04-01-02) were advanced to provide an initial assessment of subsurface conditions within the former degreaser located in Building 5. The two soil borings were advanced to depths of 5 feet bgs. Six soil samples were analyzed by the LEA laboratory for the presence of select VOCs. Based on the field GC results, four soil samples were selected to be analyzed at AEL for VOCs. The samples that were selected for analysis by AEL include the samples obtained from the 0 to 2' and 2 to 4' intervals of each boring.

No VOCs were detected in any of the samples obtained from SB-04-01-01 and SB-04-01-02.

6.3.4.2 TCE Vapor Degreaser - Building 3

A total of 16 soil borings (SB-04-02-01 through SB-04-02-16) were advanced to provide an initial assessment of subsurface conditions in the area of the existing TCE vapor degreaser in Building 3. The soil borings were advanced to depths of between 8 and 16 feet bgs. A total of 90 soil samples were analyzed by the LEA laboratory for the presence of select VOCs. Based on the field GC results, a total of 40 soil samples were selected to be analyzed at AEL for VOCs.

The samples obtained from the 2 to 4' interval for SB-04-02-05; the 2 to 4' interval for SB-04-02-06; the 2 to 4' interval for SB-04-02-07; the 4 to 6' interval for SB-04-02-15; and the 0 to 2' and 2 to 4' intervals for SB-04-02-16 were observed to be representative of fill material. Therefore, these six samples were also analyzed for SVOCs, TPH, metals and total cyanide. The samples obtained from SB-04-02-05, SB-04-02-06 and SB-04-02-07 were also selected for analysis of metals using the SPLP.

Based on the AEL laboratory analytical results, VOCs were detected in 31 of the 40 samples analyzed, as presented in Table 6-6. No SVOCs were detected in the six samples analyzed, with the exception of benzyl butyl phthalate and bis (2-ethylhexyl) phthalate which were detected in the 4 to 6' interval at SB-04-02-15. Metals were detected in all six of the soil samples analyzed. However, no metals were detected in the SPLP analysis. Based on the laboratory results, total cyanide and TPH were not detected in any of the soil samples analyzed.

6.3.4.3 TCE Vapor Degreaser - Building 8

Four soil borings (SB-04-03-01 through SB-04-03-04) were advanced to provide an initial assessment of subsurface conditions within the area of the existing TCE vapor degreaser in Building 8. The soil borings were advanced to depths of 8, 2, 2, and 2 feet bgs, respectively. Seven soil samples were analyzed by the LEA laboratory for the presence of select VOCs. Based on the field GC results five soil samples were selected to be analyzed at AEL for VOCs, metals and total cyanide. The samples that were selected for analysis by AEL include the samples obtained approximately from the 0 to 2' interval of each boring, and from the 2 to 4' interval of soil boring SB-04-03-01.

Based on the AEL laboratory analytical results, VOCs were detected in the samples obtained from the 0 to 2' interval of soil borings SB-04-03-02, SB-04-03-03, SB-04-03-04. Metals were detected in all of the soil samples analyzed. As provided in Table 6-6, total cyanide was not detected in any of the soil samples analyzed.

6.3.4.4 TCE Vapor Degreaser - Building 12 North

One soil boring (SB-04-04-01) was advanced to provide an initial assessment of subsurface conditions within the former degreaser located in northern portion Building 12. The soil boring was advanced to a depth of 4 feet bgs. A total of 2 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening both of the soil samples were selected to be analyzed at AEL for VOCs. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for the boring.

Trichloroethylene was detected in the 2 to 4' interval for SB-04-04-01. No other VOCs were detected in either of the samples collected from this location.

6.3.4.5 TCE Vapor Degreaser - Building 12 South

A total of 3 soil borings (SB-04-05-01 through SB-04-05-03) were advanced to provide an initial assessment of subsurface conditions within the area of the existing TCE vapor degreaser in

Building 12. The three soil borings were advanced to depths of 2, 6, and 6 feet bgs, respectively. A total of 8 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 5 soil samples were selected to be analyzed at AEL for VOCs. In addition, three samples were selected for analysis of metals and cyanide. The samples were analyzed from the approximate 0 to 2' for all three borings (SB-03-02-03 was 0 to 2.1') and the 2 to 4' intervals for SB-04-05-02.

VOCs were detected in two of the five of the samples analyzed, from the approximate 0 to 2' intervals for SB-04-05-01 and SB-04-05-02. Metals were detected in all five of the soil samples analyzed. Additionally, no cyanide was detected in any of the soil sample analyzed.

6.3.4.6 Former Vapor Degreaser - Building 9

A total of 2 soil borings (SB-04-06-01 and SB-04-06-02) were advanced to provide an initial assessment of subsurface conditions within the former degreaser located in Building 9. The two soil borings were advanced to depths of 4 feet bgs. A total of 4 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 4 soil samples were selected to be analyzed at AEL for VOCs. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for each of the borings.

The only VOC detected in all four samples analyzed was TCE.

6.3.5 REC 05 – Existing and Former Wastewater Treatment Plant Areas

This REC encompasses the location of both the existing and former wastewater treatment plant (WWTP) areas. While the measures employed to dismantle and decommission the former WWTP system were in accordance with an approved plan, an assessment was not performed to identify impacts to soil and/or groundwater in this area of the Site.

A total of 5 soil borings (SB-05-01-01 through SB-05-01-05) were advanced to provide an initial assessment of subsurface conditions within the former and existing WWTP area. The five soil borings were advanced to depths of between 2 and 16 feet bgs. A total of 27 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 16 soil samples were selected to be analyzed at AEL for VOCs, metals and cyanide. In addition, three of the sixteen samples were observed to be representative of fill material were also analyzed for SVOCs and TPH. The samples were analyzed from the 0 to 2' for all five borings; the approximate 2 to 4' intervals for SB-05-01-01, SB-05-01-03, and SB-05-01-06; the 6 to 8' interval for SB-05-01-01; the 8 to 10' intervals for SB-05-01-01 and SB-05-01-02; and the 10 to 12' intervals for SB-05-01-02 and SB-05-01-03.

VOCs were detected in eight of the sixteen samples analyzed. Metals were detected in all sixteen soil samples analyzed. SVOCs were detected in one of the three samples analyzed from the 6 to 8' interval of SB-05-01-01. Additionally TPH or cyanide was not detected in the soil samples analyzed.

6.3.6 REC 06 – Dust Collection System

This REC encompasses the current dust collection system at the Site. Specifically, this REC addresses six locations: 1) the polishing dust collector to the north of Building 3; 2) the dust collector in Building 3A; 3) the dust collector to the north of Building 10; 4) the dust collector in Building 12; 5) the dust collector to the south of Building 12; and 6) the dust collector to the east of Building 51A.

6.3.6.1 Polishing Dust Collector - North of Building 3

One soil boring (SB-06-01-01) was advanced and two surface soil samples (SS-06-01-01 and SS-06-01-02) were collected to provide an initial assessment of subsurface conditions within the area of the former polishing dust collector located to the north of Building 3. The soil boring was advanced to a depth of 4 feet bgs. A total of 3 soil samples were selected to be analyzed at AEL for metals and cyanide. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for SB-06-01-01 and from both surface samples which were collected within the 0 to 1' interval.

Metals were detected in the soil boring and in both surface soil samples analyzed. Additionally, no cyanide was detected in any of the soil samples analyzed.

6.3.6.2 Dust Collector - Building 3A

One soil boring (SB-06-02-01) was advanced to provide an initial assessment of subsurface conditions within the area of the dust collector in Building 3A. The soil boring was advanced to a depth of 6 feet bgs. A total of 3 soil samples were selected to be analyzed at AEL for metals and cyanide. The 4 to 6' interval from SB-06-02-01 was also selected to be analyzed for VOCs. The samples were analyzed from the 0 to 2', 2 to 4', and 4 to 6' intervals for SB-06-02-01.

Metals were detected in all three of the soil boring samples analyzed from SB-06-02-01. Additionally, no VOCs or cyanide was detected in any of the soil samples analyzed.

6.3.6.3 Dust Collector - North of Building 10

Three surface soil samples (SS-06-03-01 through SS-06-03-03) were collected to provide an initial assessment of subsurface conditions within the area of the dust collector located to the

north of Building 10. The soil samples were collected at a depth of approximately 0 to 0.5' feet bgs. The 3 soil samples were selected to be analyzed at AEL for metals and cyanide. In addition, a sample of unknown red dust-like material was collected from location SS-06-03-04. The unknown solid material was analyzed at AEL for metals (mass and SPLP) and cyanide.

Metals were detected in all three soil samples analyzed. Additionally, no cyanide was detected in any of the soil samples analyzed.

6.3.6.4 Dust Collector - Building 12

One soil boring (SB-06-04-01) was advanced and two surface soil samples (SS-06-04-01 and SS-06-04-02) were collected to provide an initial assessment of subsurface conditions within the area of the former polishing dust collector located in Building 12. The soil boring was advanced to a depth of 1.5 feet bgs. A total of 3 soil samples were selected to be analyzed at AEL for metals and cyanide. The samples were analyzed from the 0 to 1.5' interval for SB-06-04-01 and from both surface samples which were collected within the 0 to 0.5' interval.

Metals were detected in the soil boring and in both surface soil samples analyzed. Additionally, no cyanide was detected in any of the soil samples analyzed.

6.3.6.5 Dust Collector - South of Building 12

Two surface soil samples (SS-06-05-01 and SS-06-05-02) were collected to provide an initial assessment of subsurface conditions within the area of the dust collector located to the south of Building 12. The soil samples were collected at a depth of approximately 0 to 0.5' feet bgs. The 2 soil samples were selected to be analyzed at AEL for metals and cyanide.

Metals were detected in the all three of the soil samples analyzed. Additionally, no cyanide was detected in any of the soil samples analyzed.

6.3.6.6 Dust Collector - South of Building 12

Two surface soil samples (SS-06-06-01 and SS-06-06-02) were collected to provide an initial assessment of subsurface conditions within the area of the dust collector located to the east of Building 51A. The soil samples were collected at a depth of approximately 0 to 0.5' feet bgs. The 2 soil samples were selected to be analyzed at AEL for metals and cyanide.

Metals were detected in the all three of the soil samples analyzed. Additionally, no cyanide was detected in any of the soil samples analyzed.

6.3.7 REC 07 – Former and Existing AST Areas

This REC encompasses the current and former location of aboveground storage tanks (ASTs) at the Site. Specifically, this REC addresses three locations: 1) the existing 1,000-gallon waste oil AST; 2) the existing 1,400-gallon TCE AST; 3) and the former 3,000-gallon TCE AST in the vicinity of Buildings 9 and 10.

6.3.7.1 1,000 Gallon Waste Oil AST

A total of 3 soil borings (SB-07-01-01, SB-07-01-02, and SB-07-01-03) were advanced to provide an initial assessment of subsurface conditions within the area of the existing 1,000-gallon waste oil AST. The three soil borings were advanced to depths of 12, 4, and 14 feet bgs, respectively. A total of 16 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 8 soil samples were selected to be analyzed at AEL for VOCs, SVOCs, TPH, and metals. The analytical parameters were selected in accordance with the DEP analytical requirements for storage tank closure. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for each of the borings, in addition to the 8 to 10' interval for SB-07-01-01.

VOCs were detected in two of the eight samples analyzed, from the 0 to 2' and 2 to 4' intervals of soil boring SB-07-01-03. Metals were detected in all eight of the soil samples analyzed from all three borings. Additionally, no SVOCs or TPH were detected in any of the soil samples analyzed.

6.3.7.2 1,400-gallon TCE AST

A total of 2 soil borings (SB-07-02-01 and SB-07-02-02) were advanced to provide an initial assessment of subsurface conditions within the area of the existing 1,400-gallon TCE AST. The two soil borings were advanced to depths of 3 and 3.5 feet bgs, respectively. A total of 5 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening all 5 soil samples were selected to be analyzed at AEL for VOCs. The analytical parameters were selected in accordance with the DEP analytical requirements for storage tank closure. The samples were analyzed from the 0 to 2' and 2 to 3' interval for SB-07-02-01 and the 0 to 2' and 2 to 3.5' interval from SB-07-02-02.

TCE was detected in all five samples analyzed with maximum concentration of 1,200 µg/kg, detected at the 2 to 3.5' interval of SB-07-02-02. Methylene Chloride was detected in SB-07-02-01 at both 0 to 2' and 2 to 3' intervals at concentrations of 810 and 690 µg/kg, respectively.

6.3.7.3 Former 3,000-gallon TCE AST

A total of 4 soil borings (SB-07-03-01 through SB-07-03-04) were advanced to provide an initial assessment of subsurface conditions within the area of the former 3,000-gallon TCE AST. The four soil borings were advanced to depths of 8, 4, 2 and 2 feet bgs, respectively. A total of 8 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 6 soil samples were selected to be analyzed at AEL for VOCs. The analytical parameters were selected in accordance with the DEP analytical requirements for storage tank closure. The samples were analyzed from the 0 to 2' interval for all four borings and 2 to 4' interval for SB-07-03-01 and SB-07-03-02.

Trace levels of acetone and methylene chloride were each detected in one of the six samples analyzed.

6.3.8 REC 08 – Lacquer Paint Kitchen

This REC encompasses the location of the former and existing Lacquer Paint Kitchens. Specifically, this REC addresses two locations: 1) the existing Lacquer Paint Kitchen in Building 12; and 2) the former Lacquer Paint Kitchen in the vicinity of Building 9.

6.3.8.1 Existing Lacquer Paint Kitchen - Building 12

A total of 4 soil borings (SB-08-01-01 through SB-08-01-04) were advanced to provide an initial assessment of subsurface conditions within the area of the existing Lacquer Paint Kitchen in Building 12. The four soil borings were advanced to depths, between 2 and 4 feet bgs. A total of 11 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 6 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 0 to 2' feet interval for each of the borings and the approximate 2 to 4' intervals for SB-08-01-02 and SB-08-01-04.

The only VOC detected was TCE in 0 to 2' feet interval of soil Boring SB-08-01-02. Metals were detected in all six of the soil samples analyzed from all four borings. Additionally, no TPH or cyanide was detected in any of the soil samples analyzed.

6.3.8.2 Former Lacquer Paint Kitchen - Building 9

A total of 2 soil borings (SB-08-02-01 and SB-08-02-02) were advanced to provide an initial assessment of subsurface conditions within the area of the former Lacquer Paint Kitchen in the current Building 9. The two soil borings were advanced to depths of 7.75 and 6 feet bgs,

respectively. A total of 5 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening, a total of 3 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. Two samples were also selected for metals by SPLP analysis. The samples were analyzed from the 4 to 6' intervals for each of the borings and the approximate 6 to 8' interval for SB-08-02-01.

No VOCs were detected with the exception of trace levels of acetone, which was detected in one of the three samples analyzed, from the 4 to 6' interval of soil boring SB-08-02-02. Metals were detected in all three soil samples analyzed. No metals were detected by SPLP analysis. Additionally, no TPH or cyanide was detected in any of the soil samples analyzed.

6.3.9 REC 09 – Discharge Swale (Outfall 001)

This REC encompasses the location of a discharge swale associated with Outfall 001. Soils within the drainage swale along the eastern part of the Site were previously impacted by heavy metals.

A total of 6 soil borings (SB-09-01-01 through SB-09-01-06) were advanced to provide an initial assessment of subsurface conditions within the area of the existing discharge swale associated with Outfall 001. The six soil borings were advanced to depths of between 2 and 8 feet bgs. A total of 15 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 13 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. One sample was also analyzed for metals by SPLP analysis. The samples were analyzed from the 0 to 2' and 2 to 4' interval for each of the borings and the 4 to 6' interval for SB-09-01-04.

VOCs were detected in three of the thirteen samples analyzed, from the 2 to 4' interval of soil boring SB-09-01-02, the 0 to 2' intervals of soil borings SB-09-01-04 and SB-09-01-06. Metals were detected in all thirteen of the soil samples analyzed from all six borings including the SPLP analysis for the 0 to 2' interval from SB-09-01-06. Additionally, no TPH or cyanide was detected in any of the soil samples analyzed.

6.3.10 REC 10 – Historic Fill Areas

This REC encompasses the location of the possible historic fill areas at the facility. Specifically, this REC addresses eight locations: 1) Building 12 (North); 2) Building 12 (East); 3) south of Building 12; 4) east of Building 51A; 5) Building 12 (West); 6) east of Central Unit; 7) the southern extent of the Upper Parking Lot; and 8) the southern extent of the Lower Parking Lot.

It should be noted, the soil borings advanced in REC 9 were also be utilized to characterize a portion of the southerly most potential fill area associated with REC 10.

6.3.10.1 Building 12 North

One soil boring (SB-10-01-01) was advanced to provide an initial assessment of subsurface conditions within the possible fill area in the north section of Building 12. The soil boring was advanced to a depth of 5.25 feet bgs. A total of 4 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 3 soil samples was selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for the boring.

No VOCs were detected in the samples analyzed from SB-10-01-01. Metals were detected in all three of the soil samples analyzed. Additionally, no TPH or cyanide was detected in any of the soil samples analyzed.

6.3.10.2 Building 12 East

One soil boring (SB-10-02-01) was advanced to provide an initial assessment of subsurface conditions within the possible fill area in the eastern portion of Building 12. The soil boring was advanced to a depth of 2 feet bgs. A total of 1 soil sample was collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening the soil sample was selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The sample was analyzed from the 0 to 2' interval for the boring.

No VOCs were detected in the sample analyzed from SB-10-02-01. Metals were detected in the soil sample analyzed. Additionally, no TPH or cyanide was detected in the soil sample analyzed.

6.3.10.3 Building 12 South

One soil boring (SB-10-03-01) was advanced to provide an initial assessment of subsurface conditions within the possible fill area to the south of Building 12. The soil boring was advanced to a depth of 8 feet bgs. A total of 3 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 2 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 0 to 2' and 2 to 4' intervals of the boring.

No VOCs were detected in the samples analyzed from SB-10-03-01. Metals were detected in both the soil samples analyzed. Additionally, no TPH or cyanide was detected in either of the soil samples analyzed.



6.3.10.4 Building 51A East

A total of 5 soil borings (SB-10-04-01 through SB-10-04-05) were advanced to provide an initial assessment of subsurface conditions within the area of the possible historic fill area to the east of Building 51A. The five soil borings were advanced to depths of between 10 and 14 feet bgs. A total of 29 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 13 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. In addition, eight of these samples were also selected for SVOC analysis. The samples were analyzed from the 0 to 2' interval from all of the borings with the exception of SB-10-04-05; the 2 to 4' interval of SB-10-04-01 and SB-10-04-03; the 4 to 6' interval of SB-10-04-01, SB-10-04-04, and SB-10-04-05; the 8 to 10' interval of SB-10-04-02, the 8 to 8.8' interval of SB-10-04-05; and the 12 to 14' interval of SB-10-04-01.

VOCs were detected in ten of the thirteen samples analyzed, from all of the above sample locations, with the exception of the duplicate sample from the 4 to 6' interval of soil boring SB-10-04-01, the 12 to 14' interval for SB-10-04-01 and the 0 to 2' interval for SB-10-04-03. SVOCs were detected in four of the eight samples analyzed, from the 0 to 2' interval of soil boring SB-10-04-02, the 0 to 2' and 4 to 6' intervals for SB-10-04-04 and the approximate 8 to 9' interval for SB-10-04-05. Metals were detected in all thirteen of the soil samples analyzed. TPH was detected three of the thirteen samples analyzed from the 0 to 2' interval of soil boring SB-10-04-01 and, the 0 to 2' and 4 to 6' intervals for SB-10-04-04. Additionally, no cyanide was detected in any of the soil samples analyzed.

One test pit (TP-10-04-01) was also advanced to provide an additional assessment of subsurface conditions within this possible fill area. The test pit was advanced to a depth of 8 feet bgs. A total of 2 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 2 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 3 to 3.1' and 8 to 8.1' intervals of the test pit.

VOCs were detected in both of the samples analyzed from TP-10-04-01. Metals were also detected in both of the soil samples analyzed. Additionally, no TPH or cyanide was detected in either of the soil samples analyzed.

6.3.10.5 Building 12 West

A total of 2 soil borings (SB-10-05-01 and SB-10-05-02) were advanced to provide an initial assessment of subsurface conditions within the area of the possible historic fill area in the

western portion of Building 12. The two soil borings were advanced to depths of approximately 4 and 2 feet bgs, respectively. A total of 4 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening all 4 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. In addition, three of these samples were also selected for SPLP analysis of metals. The samples were analyzed from the approximate 0 to 2' intervals for both of the borings and approximate the 2 to 4' interval for SB-10-05-01.

VOCs were detected in all three of the samples analyzed. Metals were also detected in all three of the soil samples analyzed from the borings, however no metals which were analyzed by SPLP were detected. TPH was detected one of the three samples analyzed from the 0 to 2' interval of soil boring SB-10-05-02. Additionally, no cyanide was detected in any of the soil samples analyzed.

6.3.10.6 East of Central Unit

One soil boring (SB-10-06-01) was advanced to provide an initial assessment of subsurface conditions within the possible fill area approximately 250 feet to the east of the Central Unit. The soil boring was advanced to a depth of 12 feet bgs. A total of 6 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 2 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for the boring.

VOCs and Metals were detected in both samples analyzed from SB-10-06-01. Additionally, no TPH or cyanide was detected in either of the soil samples analyzed.

Additionally, one test pit (TP-10-06-01) was advanced to a depth of 8 feet bgs for further assessment of subsurface conditions within this possible fill area. A total of 2 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 2 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 0 to 4' and 8 to 8.1' intervals of the test pit.

VOCs and Metals were detected in both of the samples analyzed from TP-10-06-01. Additionally, no TPH or cyanide was detected in either of the soil samples analyzed.

6.3.10.7 Upper Parking Lot (South)

A total of 2 soil borings (SB-10-07-01 and SB-10-07-02) were advanced to provide an initial assessment of subsurface conditions within the area of the possible historic fill in the southern portion of the Upper Parking Lot. The two soil borings were advanced to depths of approximately 4 and 14 feet bgs, respectively. A total of 9 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 4 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 0 to 2' and 2 to 4' intervals of both the borings.

No VOCs were detected in any of the samples analyzed. Metals were detected in all four of the soil samples analyzed from the borings. Additionally, no TPH or cyanide was detected in any of the soil samples analyzed.

One test pit (TP-10-07-01) was also advanced to provide an additional assessment of subsurface conditions within this possible fill area. The test pit was advanced to a depth of 10 feet bgs. A total of 2 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening, a total of 2 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 3.5 to 5.5' and 5.5 to 5.6' intervals for the test pit.

VOCs and Metals were detected in both of the samples analyzed from TP-10-07-01. Additionally, no TPH or cyanide was detected in either of the soil samples analyzed.

6.3.10.8 Lower Parking Lot (South)

A total of 6 soil borings (SB-10-08-01 through SB-10-08-06) were advanced to provide an initial assessment of subsurface conditions within the southern portion of the Lower Parking Lot. The six soil borings were advanced to depths between 12 and 16 feet bgs. A total of 46 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 19 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide.

In addition, 15 of these samples were selected for SVOC analysis; six samples were selected for SPLP analysis of metals. The samples were analyzed from the 0 to 4' interval of soil borings SB-10-08-05 and SB-10-08-06; the 2 to 4' interval of SB-10-08-01; the 4 to 6' interval of SB-10-08-01, SB-10-08-05, and SB-10-08-06; the 6 to 8' interval of SB-10-08-02, SB-10-08-03, and SB-10-08-04; the 8 to 10' interval of SB-10-08-03; the 10 to 12' interval of SB-10-08-02 and SB-10-

08-06; the 12 to 14' interval of SB-10-08-01; and the 14 to 16' interval of SB-10-08-03 and SB-10-08-04.

VOCs were detected in 16 of the 19 samples analyzed from the above sample locations, with the exception of the sample from the 4 to 6' interval of soil boring SB-10-08-01, the 6 to 8' interval for SB-10-08-04 and the 10 to 12' interval for SB-10-08-06. SVOCs were detected in 5 of the 15 samples analyzed, from the duplicate sample in the 12 to 14' interval of soil boring SB-10-08-01, the 6 to 8' and 8 to 10' intervals for SB-10-08-03 and both of the duplicate samples from the 6 to 8' interval for SB-10-08-04. Metals were detected in all 19 of the soil samples analyzed from all six borings, and also in the 6 samples that were analyzed for SPLP. Additionally, no TPH or cyanide was detected in any of the soil samples analyzed.

One test pit (TP-10-08-01) was also advanced to provide an additional assessment of subsurface conditions within this possible fill area. The test pit was advanced to a depth of 11 feet bgs. A total of 4 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening, a total of 4 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 0 to 4', 4 to 6.5' and 11 to 11.1' intervals for the test pit.

VOCs and Metals were detected in all four of the samples analyzed from TP-10-08-01. Additionally, no TPH or cyanide was detected in either of the soil samples analyzed.

6.3.11 REC 11 – Former Underground Storage Tanks

This REC encompasses the location of the former underground storage tanks at the facility. Specifically, this REC addresses three locations: 1) the former 15,000-gallon Fuel Oil UST located to the south of Building 8; 2) the former 1,000-gallon gasoline UST located to the south of Building 7; and 3) the former 10,000-gallon fuel oil UST located to the south of Building 8.

6.3.11.1 Former 15,000-Gallon Fuel Oil UST

A total of 6 soil borings (SB-11-01-01 through SB-11-01-06) were advanced to provide an initial assessment of subsurface conditions within former 15,000-gallon fuel oil UST located south of Building 8. The six soil borings were advanced to depths of between approximately 4 and 11 feet bgs. A total of 18 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 13 soil samples were selected to be analyzed at AEL for VOCs, SVOCs, and TPH. The samples were analyzed from the 0 to 2' interval for all soil borings, with the exception of SB-11-01-04; from the

approximate 2 to 4' interval for all soil borings; from the 6 to 8' interval for SB-11-01-02; and the 8 to 10' interval for SB-11-01-01.

VOCs and SVOCs were not detected in from any of the above sample locations. TPH was only detected in one of the 13 samples analyzed, from the 2 to 4' interval of soil boring SB-11-01-03.

6.3.11.2 Former 1,000-Gallon Gasoline UST

A total of 3 soil borings (SB-11-02-01 through SB-11-02-03) were advanced to provide an initial assessment of subsurface conditions within the former 1,000-gallon gasoline UST located south of Building 7. The three soil borings were advanced to depths of between approximately 8 and 12 feet bgs. A total of 15 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 7 soil samples were selected to be analyzed at AEL for VOCs and TPH. In addition, five of the samples were analyzed for SVOCs, metals and cyanide. Also included in the five samples were two samples which were selected for analysis of metals by SPLP. The samples were analyzed from the 0 to 2' interval for SB-11-02-03; from the 2 to 4' interval for SB-11-02-01 and SB-11-02-03; from the 4 to 6' and 6 to 8' intervals for SB-11-02-02; and from the 10 to 12' interval for duplicate sample for SB-11-02-01.

VOCs were detected in six of the seven samples, from all soil borings with the exception of the 0 to 2' interval for SB-11-02-03. No SVOCs were detected in from any of the above sample locations. Metals were detected in all five of the samples which were analyzed including those analyzed for SPLP, which was detected in one of the two samples analyzed. In addition, no TPH was detected in any of the samples analyzed.

6.3.11.3 Former 10,000-Gallon Fuel Oil UST

One soil boring (SB-11-03-01) was advanced to provide an initial assessment of subsurface conditions within the former 10,000-gallon fuel oil UST located to the south of Building 8. The soil boring was advanced to a depth of 12 feet bgs. A total of 6 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 2 soil samples were selected to be analyzed at AEL for VOCs, SVOCs, and TPH. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for the boring.

VOCs were detected in both of the samples analyzed from SB-11-03-01. Additionally, no SVOCs or TPH was detected in either of the soil samples analyzed.

6.3.12 REC 12 – Spills/Stains on Facility Grounds

This REC encompasses the locations of any oily and/or stained floor at the facility. Specifically, this REC addresses four locations: 1) stained floor in Building 3A; 2) stained floor in Building 2A; 3) black stain on the asphalt east of Building 51A; and 4) stained floor in Building 7.

6.3.12.1 Stained Floor - Building 3A

A total of 7 soil borings (SB-12-01-01 through SB-12-01-07) were advanced to provide an initial assessment of subsurface conditions within the stained floor portion of Building 3A. The seven soil borings were advanced to depths of between 4 and 12 feet bgs. A total of 33 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 19 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. In addition, nine of these samples were also selected for SVOC analysis. A total of two of the samples were also selected for SPLP analysis of metals. The samples were analyzed from the 0 to 2' interval for all soil borings, with the exception of SB-12-01-05; the 2 to 4' interval for all seven soil borings; the 4 to 6' interval for SB-12-01-04 and SB-12-01-05; the approximate 6 to 8' interval for SB-12-01-01 and SB-12-01-04; and the 10 to 12' interval for SB-12-01-05 and SB-12-01-06.

VOCs were detected in 13 of the 19 samples analyzed, from all of the above sample locations, with the exception of the sample from the 0 to 2', the 2 to 4', and the 4 to 6' intervals of soil boring SB-12-02-01, the 0 to 2' and the 2 to 4' interval for SB-12-01-02 and the approximate 10 to 12' interval for SB-12-01-06. SVOCs were detected in 1 of the 9 samples analyzed, from the sample in the 0 to 2' interval of soil boring SB-12-01-06. Metals were detected in all 19 of the soil samples analyzed from all seven borings, and also in one of the two samples that were analyzed for SPLP. TPH was detected from nine of the nineteen samples analyzed from the seven borings. Additionally, no cyanide was detected in any of the soil samples analyzed.

6.3.12.2 Stained Floor - Building 2A

A total of 2 soil borings (SB-12-02-01 and SB-12-02-02) were advanced to provide an initial assessment of subsurface conditions within the stained floor portion of Building 2A. The two soil borings were advanced to depths of 6 feet bgs. A total of 7 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 6 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. In addition, two of these samples were also selected for SVOC analysis. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for both soil borings and the 4 to 6' interval for SB-12-02-01.

No VOCs or SVOCs were detected in any samples analyzed, from the above sample locations. Metals were detected in all 6 of the soil samples analyzed from both borings. Additionally, no TPH or cyanide was detected in any of the soil samples analyzed.

6.3.12.3 Black Stain on Asphalt

A total of 4 soil borings (SB-12-03-01 through SB-12-03-04) were advanced to provide an initial assessment of subsurface conditions within the black stained area on the asphalt east of Building 51A. The four soil borings were advanced to depths of approximately 4 feet bgs. A total of 7 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening all of the soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. In addition, five of these samples were also selected for SVOC analysis. The samples were analyzed from the approximate 0 to 2' and 2 to 4' intervals for all soil borings.

VOCs were detected in 5 of the 7 samples analyzed, from all of the above sample locations, with the exception of the sample from the approximate 0 to 2' and 2 to 4' intervals of soil boring SB-12-03-01. SVOCs were detected in 3 of the 5 samples analyzed, from the sample in the 0 to 2' and 2 to 4' intervals of soil boring SB-12-03-03 and the 2 to 4' interval for SB-12-03-04. Metals were detected in all 7 of the soil samples analyzed from all four borings. TPH was detected from 2 of the 5 samples analyzed from the 0 to 2' and 2 to 4' intervals of soil boring SB-12-03-01. Additionally, no cyanide was detected in any of the soil samples analyzed.

6.3.12.4 Stained Floor - Building 7

A total of 2 soil borings (SB-12-04-01 and SB-12-04-02) were advanced to provide an initial assessment of subsurface conditions within the stained floor portion of Building 2A. The two soil borings were advanced to depths of 4 feet bgs. A total of 4 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening all four soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for both soil borings.

VOCs were detected in all four of the soil samples analyzed, from all of the above sample locations. Metals were also detected in all four of the soil samples analyzed. TPH was detected in the sample analyzed from the 0 to 2' interval of soil boring SB-12-04-01. Additionally, no cyanide was detected in any of the soil samples analyzed.

6.3.13 REC 13 – Loading Docks

This REC encompasses the location of the four loading docks at the facility. Specifically, this REC addresses four locations: 1) Loading Dock 1 to the south of Building 8; 2) Loading Dock 2 to the south of Building 9; 3) Loading Dock 4 to the south of Building 51A; and 4) Loading Dock 5 to the east of Building 12.

6.3.13.1 Loading Dock 1

A total of 3 soil borings (SB-13-01-01 through SB-13-01-03) were advanced to provide an initial assessment of subsurface conditions within the area of Loading Dock 1 to the south of Building 8. The three soil borings were advanced to depths of 4 feet bgs. A total of 6 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 6 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for each of the borings.

No VOCs were detected in any of the six samples analyzed, from three soil borings. Metals were detected in all six of the soil samples analyzed from all three borings. Additionally, no TPH or cyanide was detected in any of the soil samples analyzed.

6.3.13.2 Loading Dock 2

One soil boring (SB-13-02-01) was advanced to provide an initial assessment of subsurface conditions within the area of Loading Dock 2 to the south of Building 9. The soil boring was advanced to a depth of 4 feet bgs. A total of 2 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 2 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for the boring.

No VOCs were detected in the two samples analyzed from the soil boring. Metals were detected in both of the soil samples analyzed from the boring. Additionally, no TPH or cyanide was detected in either of the soil samples analyzed.

6.3.13.3 Loading Dock 4

A total of 2 soil borings (SB-13-03-01 and SB-13-03-02) were advanced to provide an initial assessment of subsurface conditions within the area of the Loading Dock 4 to the south of Building 51A. The two soil borings were advanced to depths of 4 feet bgs. A total of 4 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs.

Based on the results of the initial screening a total of 4 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for each of the borings.

No VOCs were detected in any of the four samples analyzed, from two soil borings. Metals were detected in all four of the soil samples analyzed from all two borings. Additionally, no TPH or cyanide was detected in any of the soil samples analyzed.

6.3.13.4 Loading Dock 5

A total of 2 soil borings (SB-13-04-01 and SB-13-04-02) were advanced to provide an initial assessment of subsurface conditions within the area of Loading Dock 5 to the east of Building 51A. The two soil borings were advanced to depths of 2 feet bgs. A total of 2 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 2 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 0 to 2' intervals for each of the borings.

No VOCs were detected with the exception of methylene chloride, which was detected in the 2 to 2' sample analyzed, from SB-13-04-01. Metals were detected in both of the soil samples analyzed from the borings. Additionally, no TPH or cyanide was detected in either of the soil samples analyzed.

6.3.14 REC 14 – Hazardous Material Storage Areas

This REC encompasses the location of the hazardous material storage areas at the facility. Specifically, this REC addresses four locations: 1) drum storage in Building 7; 2) drum storage in Building 9; 3) Loading Dock 4 to the south of Building 51A; and 4) Loading Dock 5 to the east of Building 12.

6.3.14.1 Drum Storage - Building 7

A total of 2 soil borings (SB-14-01-01 and SB-14-01-02) were advanced to provide an initial assessment of subsurface conditions within the area of the drum storage located in Building 7. The two soil borings were advanced to depths of 8 and 4 feet bgs, respectively. A total of 6 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 4 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. One sample was also selected for metals by SPLP analysis. In addition, one of the six samples was observed to be representative of fill material

was also analyzed for SVOCs. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for each of the borings.

VOCs were detected in three of the six samples analyzed, from the 0 to 2' interval for each of the borings and the 2 to 4' interval for SB-14-01-02. SVOCs were detected in 2 to 4' interval for SB-14-01-02. Metals were detected in all six of the soil samples analyzed from all two borings. No metals that were analyzed by SPLP were detected from the 2 to 4' interval for SB-14-01-02. Additionally, no TPH or cyanide was detected in any of the soil samples analyzed.

6.3.14.2 Drum Storage - Building 9

A total of 2 soil borings (SB-14-02-01 and SB-14-02-02) were advanced to provide an initial assessment of subsurface conditions within the area of the drum storage located in Building 9. The two soil borings were advanced to depths of 2 and 8 feet bgs, respectively. A total of 4 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 4 soil samples were selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. One sample was also selected for metals by SPLP analysis. In addition, one of the six samples was observed to be representative of fill material was also analyzed for SVOCs. The samples were analyzed from the 0 to 2' interval for SB-14-02-01 and 0 to 4', 4 to 6', and 6 to 8' intervals for SB-14-02-02.

VOCs were detected in all four of the samples analyzed. Metals were detected in all four of the soil samples analyzed from all two borings. Metals that were analyzed by SPLP were detected from the 6 to 8' interval for SB-14-02-02. Additionally, no SVOCs, TPH or cyanide was detected in any of the soil samples analyzed.

6.3.14.3 Hazardous Waste Storage - Building 51A

One soil boring (SB-14-03-01) was advanced to provide an initial assessment of subsurface conditions within the hazardous waste storage area in Building 51A. The soil boring was advanced to a depth of 1.5 feet bgs. A total of 1 soil sample was collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 1 soil sample was selected to be analyzed at AEL for VOCs, metals and cyanide. The sample was analyzed from the 0 to 1.5' interval for the boring.

No VOCs were detected with the exception of methylene chloride, which was detected in the sample analyzed, from SB-14-03-01. Metals were also detected in the soil samples analyzed. Additionally, no cyanide was detected in either of the soil samples analyzed.

6.3.14.4 Drum Storage - Building 3A

One soil boring (SB-14-04-01) was advanced to provide an initial assessment of subsurface conditions within the drum storage area in Building 3A. The soil boring was advanced to a depth of 8 feet bgs. A total of 4 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 2 soil samples was selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. One sample was also selected for metals by SPLP analysis. In addition, one of the two samples was observed to be representative of fill material was also analyzed for SVOCs. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for the boring.

VOCs were detected in both of the samples analyzed, from SB-14-04-01. Metals were also detected in both of the soil samples analyzed. However, no metals that were analyzed by SPLP were detected from the 2 to 4' interval for SB-14-04-01. SVOCs were detected in the sample analyzed from the 2 to 4' interval of SB-14-04-01. Additionally, no cyanide was detected in either of the soil samples analyzed.

6.3.15 REC 15 – Electrical Transformer Areas

This REC encompasses the location of the two pad mounted electrical transformers at the Site. Specifically, this REC addresses two locations: 1) the electrical transformers to the north of Building 9; and 2) the electrical transformers to the south of Building 51A.

6.3.15.1 Electrical Transformers - North of Building 9

Six surface soil samples (SB-15-01-01 through SB-15-01-06) were collected to provide an initial assessment of subsurface conditions within the electrical transformers located to the north of Building 9. The soil samples were collected at a depth of approximately 0 to 0.5' feet bgs. A total of 6 soil samples were selected to be analyzed at AEL for TPH and PCBs. In addition, three of the six surface soil samples were also analyzed for SVOCs.

TPH was detected in 5 of the 6 the soil samples analyzed with a maximum of 4,700 mg/kg at SS-15-01-02. SVOCs were detected in all three of the samples analyzed from locations SS-15-01-04, SS-15-01-05, and SS-15-01-06. Additionally, no PCBs were detected in any of the soil samples analyzed.

6.3.15.2 Electrical Transformers - South of Building 51A

One surface soil sample (SB-15-02-01) was collected to provide an initial assessment of subsurface conditions within the electrical transformers located to the south of Building 51A.

The soil sample was collected at a depth of approximately 0 to 0.5' feet bgs. The soil sample was selected to be analyzed at AEL for SVOCs, TPH and PCBs. No SVOCs, TPH or PCBs were detected in the soil sample analyzed.

6.3.16 REC 16 – Hazardous Waste Sludge Filter Press and Storage Area

This REC encompasses the location of the Hazardous Waste Sludge Filter Press and Storage Area located to the south of the Chemical Storage Building in the Central Unit.

One soil boring (SB-16-01-01) was advanced to provide an initial assessment of subsurface conditions within Hazardous Waste Sludge Filter Press and Storage Area. The soil boring was advanced to a depth of 4 feet bgs. A total of 2 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening a total of 2 soil samples was selected to be analyzed at AEL for VOCs, TPH, metals and cyanide. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for the boring.

No VOCs were detected in either of the samples analyzed from SB-16-01-01. Metals were also detected in both of the soil samples analyzed. Additionally, no TPH or cyanide was detected in either of the soil samples analyzed.

6.3.17 REC 17 – Battery Storage Area

This REC encompasses the location of the battery storage area located to the east of Building 51A in the Lower Unit.

A total of 2 soil borings (SB-17-01-01 and SB-17-01-02) were advanced to provide an initial assessment of subsurface conditions within the battery storage area. The two soil borings were advanced to depths of 2 and 3 feet bgs, respectively. A total of 3 soil samples were collected and analyzed at AEL for metals and cyanide. The samples were analyzed from the 0 to 2' interval for both borings and 2 to 3' interval for SB-17-01-02.

Metals were detected in all three of the soil samples analyzed from all two borings. Additionally, no cyanide was detected in any of the soil samples analyzed.

6.3.18 REC 18 – Former Incinerator Area

This REC encompasses the location of the former incinerator area located to the north of Building 51A in the Lower Unit.

A total of 3 soil borings (SB-18-01-01 through SB-18-01-03) were advanced to provide an initial assessment of subsurface conditions within the former incinerator area. The three soil borings were advanced to depths of 4 bgs. A total of 6 soil samples were collected and analyzed at AEL for SVOCs, metals and cyanide. The samples were analyzed from the 0 to 2' and 2 to 4' intervals for all three borings.

No SVOCs were detected in any of the six samples analyzed. Metals were detected in all six of the soil samples analyzed from all three borings. Additionally, no cyanide was detected in any of the soil samples analyzed.

6.3.19 Additional Areas of Investigation

Based on the results of the soil vapor survey additional soil borings were installed to identify possible sources of contamination. These soil borings were advanced in the vicinity of locations where elevated trichloroethylene concentrations were detected in the soil vapor survey. For ease of presentation purposes, the nomenclature used for these soil boring locations is preceded by SB-19.

A total of 26 soil borings (i.e. SB-19-01-01, SB-19-02-01, etc.) were advanced to provide an initial assessment of subsurface conditions within the area of elevated trichloroethylene concentrations detected during the soil vapor survey. The soil borings were advanced to depths of between 2 and 16 feet bgs, respectively. A total of 26 soil samples were collected and screened by the LEA Laboratory for the presence of selected VOCs. Based on the results of the initial screening, a total of 20 soil samples were selected to be analyzed at AEL for VOCs. Two samples were also selected to be analyzed for metals by SPLP analysis. In addition, 4 of the 20 samples were observed to be representative of fill material which were also analyzed for one or all of the following: SVOCs, TPH, metals and cyanide. The samples were analyzed from the approximate 0 to 2' and 2 to 4' intervals (if available) for each of the borings.

VOCs were detected in 19 of the 20 samples analyzed, with the exception being the 2 to 4' interval for SB-19-04-07. SVOCs were detected in both of the samples analyzed from the 1 to 2' interval for SB-19-04-01 and the 2 to 3' interval for SB-19-04-05. Metals were detected in all four of the soil samples analyzed from the four borings (SB-19-01-01, SB-19-02-01, SB-19-04-01 and SB-19-04-05). No metals that were analyzed by SPLP were detected from the 1 to 2' interval for SB-19-04-01 and the 2 to 3' interval for SB-19-04-05. TPH was detected in 3 of the samples analyzed from the 0 to 2' interval for SB-19-01-01, the 1 to 2' interval for SB-19-04-01, and the 2 to 3' interval for SB-19-04-05. Additionally, no cyanide was detected in any of the soil samples analyzed.

6.4 Groundwater Sample Results

6.4.1 Overview

A description of the constituents detected in the groundwater samples obtained from the Site is presented in this section. The section is organized to present the data based on the type of location from which the samples were obtained (monitoring well, production well, or piezometer). The discussion of the groundwater sample results is further organized based on whether or not the sample was obtained from an on-site or off-site location.

A summary of groundwater sampling and analytical information is provided in Table 6-9. A summary of the groundwater sample analytical results is provided as Table 6-10. A summary of the constituents detected in groundwater samples analyzed by AEL and Lancaster Laboratories, Inc. is provided in Table 6-11.

The locations of the monitoring wells, production wells, and piezometers are illustrated on Drawing 6-2. This drawing also summarizes the laboratory analytical results for the groundwater samples analyzed.

6.4.2 Monitoring Wells

During the March 2004 sampling event, groundwater samples were obtained from eight groundwater monitoring wells. Samples were obtained from the on-site monitoring wells: OW-1, OW-2, OW-3D, and OW-3S. Samples were also obtained from monitoring wells MW-1, MW-2, MW-3, and MW-6 installed by Interstate Container Corporation to assess groundwater quality at their property. During the September 2004 sampling event, groundwater samples were obtained from these same wells. In addition, groundwater samples were obtained from the newly installed wells at the Site: MW-01, MW-02, MW-03, MW-04, MW-05S, MW-05I, MW-05D, MW-06, MW-07S, MW-07D, MW-08, MW-08S, MW-08D, and MW-09.

6.4.2.1 On-Site Monitoring Wells

Detectable concentrations of VOCs were reported for the samples obtained from each on-site monitoring well. Of the VOCs reported to be present in the groundwater samples, TCE was the most frequently detected compound. The highest TCE concentration was reported for the sample obtained from on-site monitoring well MW-06. A TCE concentration of 1,600 micrograms per liter ($\mu\text{g/l}$) (estimated) was reported for the sample obtained from this monitoring well during the September 2004 sampling event (Table 6-11).

Other VOCs detected in the samples obtained from the on-site monitoring wells include degradation products of TCE, namely: cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, and vinyl chloride (VC). Detectable concentrations of other VOCs, including benzene, 1,2-dichloroethane, and cis-1,3-dichloropropene were also reported for the samples analyzed.

Also, detectable concentrations of metals were reported for the samples obtained from each on-Site well. In total, six different metals were detected in the groundwater samples analyzed, as shown in Table 6-11. The metals that were detected include barium, chromium, copper, lead, nickel, and zinc. Total cyanide was not detected in any of the samples analyzed. Likewise, hexavalent chromium was not detected in any of the samples analyzed.

6.4.2.2 Off-Site Monitoring Wells

Detectable concentrations of VOCs were reported for the samples obtained from each off-site monitoring well. Of the VOCs reported to be present in the groundwater samples, TCE and PCE were the most frequently detected compounds. The concentrations of TCE were reported to be estimated. The highest concentration of PCE was reported for the sample obtained from off-Site monitoring well MW-1. A TCE concentration of 2.6 µg/l was reported for the sample obtained from this monitoring well during the March 2004 sampling event (Table 6-11).

In total four different VOCs were detected in the groundwater samples analyzed. The maximum concentration of each VOC detected is as follows: methylene chloride at 2.8 µg/l (detected in the laboratory blank); PCE (2.6 µg/l); TCE (0.7 L µg/l); and toluene (3.4 µg/l).

Also, detectable concentrations of barium and zinc were reported for the samples obtained from the off-Site wells. No other metals were reported to be present in these samples. Total cyanide was not detected in any of the samples analyzed. Likewise, hexavalent chromium was not detected in any of the samples analyzed.

6.4.3 Production Wells

During the March and September 2004 groundwater sampling events, groundwater samples were obtained from each of the five on-site production wells (PS-1, PS-2, PS-3, PW-4, and PW-5). Detectable concentrations of VOCs were reported for the samples obtained from each production well. TCE was the most frequently detected VOC compound. The highest TCE concentration was reported for the sample obtained from production well PW-5. A TCE concentration of 130 µg/l was reported for the sample obtained from this monitoring well during the March 2004 sampling event (Table 6-11).

Other VOCs detected in the samples obtained from the on-site production wells include 1,1-dichloroethane, 1,1-dichloroethylene, cis-1,2-dichloroethylene, and PCE. Also, detectable concentrations of metals were reported for the samples obtained from the on-site production wells. In total, six different metals were detected in the groundwater samples analyzed, as shown in Table 6-11. The metals that were detected include barium, chromium, copper, lead, nickel, and zinc. Total cyanide and hexavalent chromium was not detected in any of the samples analyzed.

6.4.4 Piezometers

A total of 22 piezometers were sampled during the March and September 2004 groundwater sampling events. The piezometers installed on-Site include: P-4S, P-4I, P-4D, P-5I, P-5D, PZ-10I, PZ-20S, PZ-20, PZ-20D, PZ-30S, PZ-30I, PZ-30D, PZ-40S, PZ-50S, PZ-50I, PZ-50D, PZ-60I, and PZ-60D. The remaining four piezometers, P-1, P-3S, P-3I, and P-3D, are located off-site on the Schlegel Park property to the southeast.

6.4.4.1 On-Site Piezometers

Detectable concentrations of VOCs were reported for the samples obtained from each on-Site piezometer. TCE was the most frequently detected VOC compound. The highest TCE concentration was reported for the sample obtained from piezometer PZ-40S. A TCE concentration of 13,000 µg/l was reported for the sample obtained from this monitoring well during the September 2004 sampling event (Table 6-11).

Other VOCs detected in the samples obtained from the on-Site piezometers include degradation products of TCE, namely: cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, and vinyl chloride (VC). Detectable concentrations of other VOCs, including 1,1-dichloroethane, TCA, PCE, and VC were also reported for the samples analyzed.

Also, detectable concentrations of metals were reported for the samples obtained from the on-Site piezometers. In total, five different metals were detected in the groundwater samples analyzed, as shown in Table 6-11. The metals that were detected include barium, cadmium, copper, nickel, and zinc. Total cyanide was not detected in any of the samples analyzed. Likewise, hexavalent chromium was not detected in any of the samples analyzed.

6.4.4.2 Off-Site Piezometers

Detectable concentrations of VOCs were reported for the samples obtained from each off-Site piezometer. The VOCs reported to be present in these samples include: 1,1-dichloroethane, 1,1-dichloroethylene, cis-1,2-dichloroethylene, TCA, TCE, and VC. The greatest number of VOCs

was reported to be present in the sample obtained from piezometer P-3I. A TCE concentration of 2.1 µg/l was reported to be present in the sample obtained from this piezometer in September 2004 (Table 6-11).

Also, detectable concentrations of metals were reported for the samples obtained from the off-site piezometers. In total, four different metals were detected in the groundwater samples analyzed, as shown in Table 6-11. The metals that were detected include barium, copper, lead, and zinc. Total cyanide was not detected in any of the samples analyzed. Likewise, hexavalent chromium was not detected in any of the samples analyzed.

6.5 Quality Assurance/Quality Control Sample Results

6.5.1 Overview

The results of the samples analyzed as part of the QA/QC process are presented in this section. The results include field duplicate sample results for the additional soil vapor samples obtained from Buildings 3, 12, and 51. The results also include field duplicate sample results for the soil and groundwater samples obtained at the Site. In addition, the QA/QC sample results presented in this section include the trip blank sample results for the trip blanks prepared by AEL for the soil and groundwater samples obtained for the laboratory analysis of VOCs. The QA/QC sample results presented in this section also include the results obtained for the equipment rinsate blanks prepared by LEA as part of the soil and groundwater investigations.

6.5.2 Duplicate Sample Results

For the additional soil vapor samples that were submitted for laboratory analysis, a duplicate sample was obtained from soil vapor sample location SV-03-05. A summary of the soil vapor sampling and analytical information for the duplicate sample pair obtained at this location is provided as Table 6-12. A summary of the duplicate soil vapor sample laboratory analytical results is provided as Table 6-13. As shown in Table 6-13, chloroform, TCE, and toluene were reported to be present at relatively the same concentration in each sample of the duplicate pair. The only other VOC reported to be present was n-hexane. This compound was detected in one sample of the duplicate sample pair at a concentration of 100 µg/m³. The reported concentration is just above the detection limit (97 µg/m³). This compound was reported to be less than the detection limit in the other sample.

A summary of the duplicate soil sampling and analytical information is provided as Table 6-14. Duplicate soil sample analytical results are summarized in Table 6-15. As shown in this table,

the relative percent difference (RPD) is presented for each constituent detected in the duplicate pair of soil samples obtained.

A summary of the duplicate groundwater sampling and analytical information is provided as Table 6-16. A summary of the duplicate groundwater sample laboratory analytical results is provided as Table 6-17. As shown in Table 6-17, the constituents detected in each sample of the duplicate pair were reported to be present at relatively the same concentration.

6.5.3 QA Blank Sample Results

6.5.3.1 Overview

A summary of the QA blank sampling and analytical information is provided in Table 6-18. This table includes a summary of the sampling and analytical information for both the trip blanks prepared by AEL and the equipment rinsate blanks prepared in the field by LEA. A summary of the QA blank sample laboratory analytical results is provided as Table 6-19, which includes a summary of the laboratory analytical results for both the equipment rinsate blanks and the trip blanks.

6.5.3.2 Equipment Rinsate Blank Sample Results

As provided in Table 6-19, VOCs were detected in a few of the equipment rinsate blank samples. The detected VOCs include methylene chloride, toluene, and TCE. For each of the equipment rinsate blank samples in which these compounds were reported to be present, the reported concentrations were qualified due to contamination of the associated laboratory method blank, or were estimated at concentrations above the method detection limit (MDL) but less than the quantitation limit.

Also as provided in Table 6-19, zinc and copper were detected in a few of the equipment rinsate blank samples. Where detected, zinc was reported to be present just above the reporting limit (0.010 mg/l). A maximum concentration of 0.018 mg/l was reported for the equipment rinsate blank samples. Copper was detected in only one equipment rinsate blank sample. Where detected, copper was reported to be present at the reporting limit (0.005 mg/l).

6.5.3.3 Trip Blank Sample Results

As provided in Table 6-19, VOCs were detected in a few of the trip blank samples. The detected VOCs include acetone, methylene chloride, and toluene. These compounds are common laboratory artifacts. For the trip blank submitted with the soil samples obtained on March 2, 2004, methylene chloride was reported to be present at a concentration of 2.2 µg/l. For each of

the other trip blank samples in which these VOCs were detected, the compounds were reported to be present due to contamination of the associated laboratory method blank, or were estimated at concentrations above the MDL but less than the quantitation limit.

The only other VOC detected in any of the trip blank samples was TCE. This compound was reported to be present only in the trip blank sample submitted with the groundwater samples obtained on September 8, 2004. The TCE concentration (1.2 µg/l) reported for this sample was qualified because TCE was detected in the laboratory method blank associated with this sample, and because the result was detected above the MDL but less than the quantitation limit, and was therefore reported to be estimated.

7. EVALUATION OF RESULTS

7.1 Overview

An evaluation of the results obtained from the Phase II/III investigative activities is provided in this section. This section is organized to present a discussion of the hydrogeologic observations and data recorded in the field. This information and data include a description of the geologic materials present beneath the Site. The information also includes a description of hydrogeologic conditions present at the Site, including an evaluation of the data recorded during the groundwater monitoring performed as described in Section 4.6.

This section is also organized to present a discussion of the analytical results for all soil vapor, soil, and groundwater obtained during the course of investigations at the Site. The applicable evaluation criteria are first defined. A discussion is then provided for the evaluation of the results relative to these criteria.

An evaluation of the analytical results obtained for the samples that were analyzed as part of the QA/QC process is also provided in this section. This evaluation includes an evaluation of the results obtained for duplicate field samples. This evaluation also includes an evaluation of trip blanks prepared by AEL, and equipment rinsate blanks prepared by LEA in the field.

7.2 Site Geologic Conditions

The geologic materials encountered during the advancement of soil borings at the Site consist of unconsolidated materials weathered from primarily limestone and dolomite. The unconsolidated materials at the Site consist predominantly of sandy silts and sandy clays. In the south-central portion of the Site, fill material consisting of sandy silts and sandy clays was encountered. The fill is located in the vicinity of production well PW-5, and extends to a maximum depth of approximately 20 feet bgs. For several soil borings advanced within this area, the soils encountered were observed to be stained.

Bedrock underlying the unconsolidated materials present at the Site consists primarily of limestone and dolomite. The carbonate rocks are inter-bedded with shale sequences. Differential weathering of the underlying carbonate system is evidenced by sinkholes observed at the Site at the ground surface.

7.3 Site Hydrogeologic Conditions

Dissolution of the limestone and dolomite sequences underlying the Site has created voids through which groundwater primarily migrates. A significant void has been identified to intersect production well PW-5. During the advancement of the soil borings for monitoring wells MW-07D and MW-08D, fractured bedrock was encountered at a depth that corresponds to the void identified to intersect production well PW-5. Based on observations made during drilling advancement, and during the monitoring conducted to assess aquifer response to production well pumping, the fractures are hydraulically connected to this void.

Groundwater flow beneath the Site in both the overburden and bedrock aquifer is generally toward the southeast. The flow of groundwater in the bedrock aquifer is strongly influenced by pumping groundwater from the production wells at the Site. In particular, groundwater flow within bedrock at the Site is primarily influenced by pumping groundwater from production well PW-5. An approximately 800 foot long capture zone, oriented perpendicular to the direction of groundwater flow, is present under sustained pumping conditions along the southern and eastern property boundaries. The capture zone is oriented parallel to an east-west trending fracture system intersected by monitoring wells MW-07B, MW-08D and production well PW-5.

From the data gathered during the groundwater monitoring at the Site, the existing hydraulic control system appears to effectively capture contaminated groundwater within the bedrock aquifer at the site. However, groundwater within the overburden is likely migrating offsite without being captured in the south-central and southeastern portion of the property, where the highest levels of contamination were detected in groundwater. Information supporting the conclusion relative to the offsite migration of contaminated groundwater in the overburden includes:

- a bedrock high located downgradient of PZ-40S and pumping well PW-5, that was identified at the MW-07 well cluster, creates a divide in the overburden aquifer;
- groundwater elevations within the overburden in the vicinity of production well PW-5 indicate groundwater flow in the overburden toward the northeast and southwest away from the vicinity of well PZ-40S; and
- significant TCE contamination detected in soil and groundwater in the vicinity of piezometer PZ-40S and monitoring wells MW-06 .

7.4 Evaluation of Soil Vapor Sample Results

The soil vapor sample results that are summarized in Table 6-4 have been evaluated were evaluated relative to the criteria published in the PADEP guidance document, *Vapor Intrusion into Buildings from Groundwater and Soil under the Act 2 Statewide Health Standard* (PADEP 2004). However, it must be noted that the soil vapor sampling was conducted for screening of potential release areas and was not intended to comply with PADEP sampling protocol for soil vapor intrusion assessment. The results of this evaluation are presented in Table 7-1.

As shown in Table 7-1, a number of VOCs are present within soil vapor beneath Buildings 3, 12, and 51 at concentrations that exceed the criteria. The VOCs exceed the criteria at several locations beneath each building. The soil vapor sample locations are illustrated on Drawing 4-1. The locations from which soil vapor samples contained VOCs at concentrations that exceed the criteria are summarized as follows:

- Within Building 3, TCE was reported to be present in soil vapor at a concentration of: 220,000 $\mu\text{g}/\text{m}^3$ at location SV-03-01; 10,000,000 $\mu\text{g}/\text{m}^3$ at location SV-03-02; 96,000 $\mu\text{g}/\text{m}^3$ at location SV-03-03; 100,000 $\mu\text{g}/\text{m}^3$ at location SV-03-04; 52,000 $\mu\text{g}/\text{m}^3$ at location SV-03-05; and 670,000 $\mu\text{g}/\text{m}^3$ at location SV-03-06.
- Within Building 3, methylene chloride was reported to be present in soil vapor at a concentration of 19,000 $\mu\text{g}/\text{m}^3$ at location SV-03-02.
- Within Building 12, 1,1-dichloroethane was reported to be present in soil vapor at a concentration of 32,000 $\mu\text{g}/\text{m}^3$ at location SV-12-06.
- Within Building 12, TCE was reported to be present in soil vapor at a concentration of: 25,000 $\mu\text{g}/\text{m}^3$ at location SV-12-02; 49,000 $\mu\text{g}/\text{m}^3$ at location SV-12-03; 100,000 $\mu\text{g}/\text{m}^3$ at location SV-12-04; 42,000 $\mu\text{g}/\text{m}^3$ at location SV-12-05; and 4,200,000 $\mu\text{g}/\text{m}^3$ at location SV-12-06; and
- Within Building 51, TCE was reported to be present in soil vapor at a concentration of: 10,000 $\mu\text{g}/\text{m}^3$ at location SV-51-02; 35,000 $\mu\text{g}/\text{m}^3$ at location SV-51-03; 37,000 $\mu\text{g}/\text{m}^3$ at location SV-51-04; and 21,000 $\mu\text{g}/\text{m}^3$ at location SV-51-05.

7.5 Evaluation of Soil Sample Results

7.5.1 Overview

An evaluation of the soil laboratory analytical results is provided in this section. As presented, the results were evaluated relative to the PADEP Statewide Health Standard - Medium Specific Concentrations (MSCs), which are provided in Appendix C to Chapter 250.708 of Title 25 of the Pennsylvania Code. The evaluation of the results includes a comparison to all relevant criteria, including the Direct Contact Numeric Values and a comparison to the Soil to Groundwater Numeric Values for each constituent detected in the Site soil. A qualitative comparison of the analytical results to the MSCs is included to provide an understanding of the magnitude of contamination identified in the soil, and to identify areas where remediation may be necessary to comply with the MSCs.

7.5.2 Direct Contact Criteria

Of the 379 soil samples that were collected at the Site only one sample, designated as SB-19-04-05, exceeds the Direct Contact MSCs for non-residential soil. This sample was obtained from beneath the concrete slab in Building 12. The soil sample was collected from the 2 to 3' sampling interval at this location, and therefore the "more than 2 feet" criteria are applicable. The sample obtained from this location was reported to contain a concentration of 1,1-dichloroethylene at a concentration of 70,000 µg/kg. This concentration exceeds the MSC of 38,000 µg/kg. The reported concentration for the soil sample is above the calibration range of the analytical instruments and therefore the reported value is estimated. There were no exceedances of the Direct Contact MSCs for the "less than 2 feet" criteria at this location. A summary of the exceedances of Direct Contact Numeric Values for non-residential soil is provided as Table 7-2.

7.5.3 Soil to Groundwater Criteria

In evaluating the soil laboratory analytical results against the soil to groundwater criteria, the results were compared to the following two criteria: (i) the value that is 100 times the appropriate groundwater MSC; and (ii) the "generic value". The soil results were evaluated for a non-residential, non-used aquifer. A summary of the soil laboratory analytical results that exceed the "generic value" is provided in Table 7-3. A summary of the soil laboratory analytical results that exceed the value that is 100 times the appropriate groundwater MSC is provided as Table 7-4. In accordance with the Statewide Health Standards, constituent concentrations detected in soil exceed the soil to groundwater criteria only if the results exceed both criteria.

The results reported for the following samples exceed the soil to groundwater criteria:

- SB-19-04-05, at which location the sample obtained from the 0 to 2' sampling interval exceeds the criteria for TCE, and the sample obtained from the 2 to 3' sampling interval exceeds the criteria for 1,1-dichloroethylene, TCE, and PCE;
- SB-19-04-01, at which location the sample obtained from the 0 to 1' sampling interval exceeds the criteria for PCE;
- SB-04-02-0-3, at which location the sample obtained from the 0 to 2' and 2 to 4' sampling intervals exceed the criteria for TCE; and
- SB-04-02-0-5, at which location the sample obtained from the 0 to 2' and 2 to 4' sampling intervals exceed the criteria for TCE.

7.6 Evaluation of Groundwater Sample Results

7.6.1 Overview

An evaluation of the groundwater laboratory analytical results is provided in this section. As presented, the results were evaluated relative to the PADEP Statewide Health Standard – MSCs for a non-used, non-residential aquifer. The results were also evaluated relative to the Safe Drinking Water Act (SDWA) Federal Drinking Water Standards. These Federal standards include the primary and secondary Maximum Contaminant Levels (MCLs), and the Lead/Copper Rule Levels.

7.6.2 Medium-Specific Concentrations

As shown in Table 7-5, concentrations of TCE exceed the MSC for a non-used, non-residential aquifer for samples obtained from several locations. The MSC for TCE for a non-used, non-residential aquifer is 50 µg/l. The MSC for TCE is exceeded for samples obtained from the following wells and piezometers: MW-03 (130 µg/l), MW-04 (250 µg/l (estimated)), MW-06 (1,600 µg/l estimated), OW-2 (250 µg/l), PW-5 (250 µg/l), PZ-30S (640 µg/l), PZ-40S (13,000 µg/l), and P-4S (330 µg/l).

Also as shown in Table 7-5, the concentration of 1,1-dichloroethylene exceeds the MSC for a non-used, non-residential aquifer for the groundwater sample obtained from PZ-40S (1,400 µg/l). The concentration of cis-1,2-dichloroethylene (83 µg/l) also exceeds the MSC for a non-used, non-residential aquifer for the sample obtained from this piezometer. No other constituents detected in the groundwater samples obtained during the Phase II/III investigation were reported to exceed the applicable MSCs.

7.6.3 Federal Drinking Water Standards

Concentrations of constituents detected in groundwater were also compared to applicable MCLs and the Lead/Copper Rule Levels. A summary of the groundwater laboratory analytical results that exceed the primary MCLs is provided in Table 7-6. There were no exceedances of the secondary MCLs, and therefore no summary table is provided.

As shown in Table 7-6, several VOCs were detected in Site groundwater at concentrations that exceed the primary MCLs. These VOCs include benzene, carbon tetrachloride, TCA, 1,1,2-trichloroethane, 1,1-dichloroethylene, cis-1,2-dichloroethene, TCE, and VC. Concentrations of these compounds exceed the primary MCLs in samples that were obtained primarily from the production wells and from wells and piezometers installed in the southern portion of the property.

Also as shown in Table 7-6, chromium (total) exceeds the primary MCL in the groundwater sample obtained from monitoring well OW-3S. A concentration of 0.117 mg/l was reported to be present in this sample. Hexavalent chromium was not detected in this sample or in any of the groundwater samples obtained from the Site.

A summary of the groundwater laboratory analytical results that exceed the Lead/Copper Rule Levels is provided in Table 7-7. As shown in this table, lead was reported to be present at a concentration of 0.0157 mg/l in the sample obtained from production PS-3. The reported concentration exceeds the lead standard of 0.015 mg/l.

7.7 Evaluation of QA/QC Sample Results and Data Quality Objectives

7.7.1 Evaluation of Duplicate Sample Results

The results of the duplicate pairs of soil vapor, soil, and groundwater samples that are summarized in Tables 6-12 through 6-17 have been evaluated to assess the precision associated with the sample collection and analytical process. The evaluation process was performed in general accordance with the EPA document entitled *Region I Functional Guidelines for Data Validation*. In accordance with the procedures for data validation presented in this document, the RPD was calculated for each duplicate sample pair. As described in the EPA document, the acceptable RPD for duplicate samples is up to 50% for constituents that were detected at a concentration at least two times the reported MDL. For constituents that were detected at less than two times the MDL, the RPD limit does not apply.

The results of this evaluation for the duplicate pair of additional soil vapor samples are provided in Table 6-14. As shown in this table, the RPD calculated for each of the detected VOCs is less than 50%. Based on the evaluation performed, the precision associated with the soil vapor sample collection and analytical process satisfies the DQOs. This precision does not affect the usability of the data.

The evaluation of the duplicate pair of soil samples is summarized in Table 6-15. As shown in this table, the RPD calculated for each of the detected constituents is less than 50%. Based on the evaluation performed, the precision associated with the soil sample collection and analytical process satisfies the DQOs. This precision does not affect the usability of the data.

The evaluation of the duplicate pair of groundwater sample is summarized in table 6-17. As shown in this table, the RPD calculated for each of the detected constituents is less than 50%. Based on the evaluation performed, the precision associated with the groundwater sample collection and analytical process satisfies the DQOs. This precision does not affect the usability of the data.

7.7.2 Evaluation of Trip Blank Samples

The results of the trip blank samples that are summarized in Tables 6-19 have been evaluated to identify the presence of VOC contamination attributable to transfer across a sample container septum during the shipment and storage of samples. The evaluation process was performed in general accordance with the EPA document entitled *Region I Functional Guidelines for Data Validation*. In accordance with the procedures for data validation presented in this document, the compounds detected in the trip blank samples were evaluated to assess whether or not the compounds were detected in any of the associated field samples.

As provided in Section 6.5.3.3, methylene chloride (2.2 µg/l) was reported to be present in the trip blank sample submitted with the soil samples obtained on March 2, 2004. This VOC was not detected in any of the field soil samples associated with this QA sample. Thus, there was no VOC contamination that may be attributable to transfer across the sample containers. The presence of methylene chloride in this QA sample does not affect the usability of the data, and the DQOs are deemed to be satisfied.

7.7.3 Evaluation of Equipment Rinsate Blank Samples

The results of the equipment rinsate blank samples that are summarized in Table 6-19 have been evaluated to assess the adequacy of field decontamination procedures. As discussed in Section 6.5.3.2, methylene chloride was the only VOC detected in the equipment rinsate blank samples at

concentrations not qualified by AEL. For the field samples associated with these QA samples, methylene chloride was not detected. Thus, the field decontamination procedures are deemed to have been adequate with respect to this QA sample. The usability of the data are not affected and the DQOs are satisfied.

Also as discussed in Section 5.5.3.2, copper and zinc were the only inorganic constituents detected in the equipment rinsate blank samples. These constituents were reported to be present at concentrations just above the reporting limits. For all of the field samples in which copper and zinc were reported to be present, the reported concentrations are below the applicable MSCs. Thus, the field decontamination procedures do not affect the usability of the data, and the DQOs are satisfied.

8. SUMMARY OF FINDINGS

Potential future costs for remedial actions and/or further characterization of releases identified at the Site have been provided to The Black & Decker Corporation under separate cover. A summary of the relevant findings from the investigation activities conducted at the Site is presented below.

- Concentrations of TCE and methylene chloride in soil vapor beneath the concrete slab of Building 3 exceed the applicable DEP soil vapor criteria.
- Concentrations of TCE and 1,1-dichloroethane in soil vapor beneath the concrete slab of Building 12 exceed the applicable DEP soil vapor criteria.
- Concentrations of TCE in soil vapor beneath the concrete slab of Building 51 exceed the applicable DEP soil vapor criteria.
- In the vicinity of production well PW-5, fill material consisting of sandy silts and sandy clays was encountered that extends to a maximum depth of approximately 20 feet bgs, and which contains stained soils. This fill material has been impacted by a release of chlorinated hydrocarbons.
- Subsurface soils within a limited area beneath Building 3 contain VOCs at concentrations that exceed the applicable soil-to-groundwater criteria.
- Subsurface soils within a limited area beneath Building 12 contain TCE at concentrations that exceed the applicable direct contact criteria.
- Subsurface soils within a limited area beneath Building 12 contain VOCs at concentrations that exceed the applicable soil-to-groundwater criteria.
- Subsurface soils within a limited area east of Building 51A contain TCE and several SVOCs at concentrations that exceed the applicable soil-to-groundwater criteria.
- The existing hydraulic control system appears to effectively capture contaminated groundwater within the bedrock aquifer at the Site. An approximately 800 foot long capture zone, oriented perpendicular to the direction of groundwater of flow, is present under sustained pumping conditions along the southern and eastern property boundaries. The capture zone is oriented parallel to an east-west trending fracture system in the southern

portion of the property. A majority of the groundwater pumped from production wells PW-4 and PW-5 is believed to be withdrawn from this fracture system.

- Groundwater within the overburden at the Site is likely migrating offsite along the south-central and southeastern property boundary without being captured by the hydraulic control system. It is in this same area that the highest levels of contamination were detected. The extent to which migration occurs in the overburden aquifer is unclear, as is the significance of any such migration with respect to downgradient receptors.



9. REFERENCES

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TABLES

FIGURES

DRAWINGS

APPENDIX A

Loureiro Engineering Associates, Inc. Standard Operating Procedures

APPENDIX B

Geologic Boring Logs

APPENDIX C

Geophysical Borehole Logging and Packer Testing Report

APPENDIX D

Monitoring Well Construction Logs

APPENDIX E

Aquifer Response Graphs